18

PAN AMERICAN AIR POLLUTION MONITORING NETWORK (REDPANAIRE)

REPORT 1967 - 1974

ENVIRONMENTAL HEALTH DIVISION
TECHNICAL SERIES

PAN AMERICAN CENTER FOR SANITARY ENGINEERING AND ENVIRONMENTAL SCIENCES (CEPIS)

PAN AMERICAN HEALTH ORGANIZATION
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The Director of CEPIS is very pleased to express here his acknowledgment and gratitude to everyone who collaborated with this program, contributing in this way to a better diagnosis of the air pollution problem in Latin America and the Caribbean.

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1. BACKGROUND

In 1971 the Pan American Health Organization (PAHO) presented to the Health Authorities of Latin America and the Caribbean the first report of the results of the REDPANAIRE[1], covering data collected between 1967 and 1970. Five years later a new consolidated report has been prepared, in which the previous results and those gathered between 1971 and 1974 are presented and an attempt is made to analyze them. The task has not been easy. The number of stations increased from 34 to 93, the number of cities included rose from 18 to 29, and the amount of data collected more than quintupled. The excellent collaboration given by the national authorities in charge of operating the stations facilitated the collection of results. The experience gained through this endeavor should be very useful in preparing future reports, which will likewise depend on the continued and enthusiastic support of the participant countries.

The Ten-Year Health Plan for the Americas[2], approved in November 1972 by the III Special Meeting of Ministers of Health of the Americas, included among its recommendations on environmental health the following:

> *"To formulate and execute air pollution control programs in urban areas with more than 500 000 inhabitants and in other cities where industrialization or other special considerations justify the need for such measures."*

The Pan American Center for Sanitary Engineering and Environmental Sciences (CEPIS), a PAHO Regional Center, has prepared a list of cities in Latin America and the Caribbean where, according to the preceding recommendation, control programs should be formulated. As shown in Table 1, of a total of 87 cities, 33 already have more than 500 000 inhabitants, 20 will surely exceed this figure during the decade, and another 34, of lesser size, have current or potential air pollution problems.

Of the 29 cities included in this report, 21 fall into the first category, five into the second, and three into the third. CEPIS hopes that this collaboration to a better diagnosis of the problem will help in meeting the goals of the Ten-Year Health Plan.

It should be stressed that the responsibility for operating the stations and, as a consequence, the quality of results, belongs exclusively to the countries involved. Sampling programs are part of national evaluation, prevention, and control programs. The role of PAHO and CEPIS is to provide the technical assistance deemed necessary, to coordinate the different programs, to transmit to every country the experience obtained in the others, and to collect, with the collaboration of the participant agencies,

Table 1

87 cities of Latin America and the Caribbean where air pollution control programs should be started, according to the goals of the III Special Meeting of the Ministers of Health of the Americas

Country	City	Category
Argentina	Bahia Blanca	3
	Buenos Aires	1
	Cordoba	1
	Corrientes	3
	La Plata	1
	Mar del Plata	2
	Mendoza	2
	Parana	3
	Rosario	1
	Salta	3
	San Juan	3
	Santa Fe	3
	Tucuman	2
Bahamas	Freeport	3
Barbados	Bridgetown	3
Bolivia	La Paz	2
Brazil	Americana	3
	Belem	1
	Belo Horizonte	1
	Brasilia	2
	Campinas	3
	Campos	2
	Caxias do Sul	3
	Curitiba	1
	Fortaleza	1
	Juiz de Fora	3

Country	City	Category
Brazil	Nova Hamburgo	3
	Pelotas	3
	Piracicaba	3
	Porto Alegre	1
	Recife	1
	Riberao Preto	3
	Rio de Janeiro	1
	Salvador	1
	Santos	2
	Sao Paulo	1
Chile	Concepcion	2
	Santiago	1
	Valparaiso	1
Colombia	Barranquilla	1
	Bogota	1
	Bucaramanga	2
	Cali	1
	Cartagena	2
	Medellin	1
Costa Rica	San Jose	3
Cuba	Camagüey	3
	Cienfuegos	3
	Holguin	3
	Havana	1
	Matanzas	3
	Nuevitas	3
	Pinar del Rio	3

Country	City	Category
Cuba	Sagua la Grande	3
	Santa Clara	3
	Santiago de Cuba	3
Republica Dominicana	Santo Domingo	1
Ecuador	Guayaquil	1
	Quito	1
El Salvador	San Salvador	2
Guatemala	Guatemala	1
Guyana	Georgetown	3
Haiti	Port-au-Prince	2
Jamaica	Kingston	1
Honduras	Tegucigalpa	3
Mexico	Ciudad Juarez	2
	Guadalajara	1
	Mexico City	1
	Monterrey	1
	Puebla	2
Nicaragua	Managua	2
Panama	Panama	2

Country	City	Category
Paraguay	Asuncion	2
Peru	Arequipa	2
	Chiclayo	3
	Chimbote	3
	Lima	1
	Trujillo	3
Surinam	Paramaribo	3
Trinidad/Tobago	Port of Spain	1
Uruguay	Montevideo	1
Venezuela	Barquisimeto	2
	Caracas	1
	Ciudad Guayana	3
	Maracaibo	1
	Maracay	3
	Valencia	2

Summary:

Category 1	33
Category 2	20
Category 3	34
TOTAL	87

Categories:
1 - 500 000 inhabitants or more
2 - Less than 500 000 inhabitants, but expected to exceed this figure during the decade
3 - Other cities with current or potential air pollution problems

process, tabulate, analyze, and disseminate the results obtained among the interested parties. It is hoped that this work will help to improve the programs operating in the Region, to expand monitoring and evaluation programs, to guide programs of prevention and control, and to safeguard the inhabitants of Latin America and the Caribbean from the serious consequences to their health and economy that air pollution has produced, and is producing, in more industrialized countries. In this manner CEPIS believes to be helping to accomplish the high mission entrusted by the Member Countries to the Pan American Health Organization.

2. METHODS OF SAMPLING AND ANALYSIS

REDPANAIRE originally included the determination of:

- Settled dust. Monthly averages.
- Suspended dust. Daily averages.
- Sulfur dioxide. Daily averages.

A method for the determination of monthly averages for atmospheric corrosivity, still in its experimental stage, was subsequently added at some stations. The results of the latter technique do not appear in this report, but CEPIS hopes to prepare a special one on this matter soon.

The methods used are basically the following:

2.1 Settled dust

An open plastic jar is left exposed to the atmosphere for one month. After this period it is taken to the laboratory, where the dust is collected, dried, and weighed. Results are expressed in milligrams per cm^2 per 30 days ($mg/cm^2/30$ days).

2.2 Suspended dust

Air is passed through a filter paper during 24 hours by a system which includes a pump and a gas meter. Loss of reflectivity of the paper is measured photoelectrically. Suspended dust concentration is determined by a standardized curve and is expressed in micrograms per m^3 ($\mu g/m^3$).

2.3 Sulfur dioxide

A Drechsel flask is added to the equipment used for the preceding method. After the air passes through the filter paper, it bubbles through a hydrogen peroxide solution which retains sulfur dioxide and oxidizes it to sulfuric acid. The increase in acidity is determined volumetrically. Average atmospheric concentration is calculated in micrograms per m^3 ($\mu g/m^3$).

3. REPRESENTATIVITY OF ANALYZED POLLUTANTS

The pollutants measured by the REDPANAIRE correspond mainly to by-products of combustion emitted from stationary sources and, in part, to natural sources of pollution. REDPANAIRE does not measure pollutants produced by motor vehicles. Unfortunately, there are no simple methods for these determinations. Problems due to carbon monoxide and photochemical oxidants can be important in certain cities, and some authorities have already started to measure them, acquiring for this purpose relatively high priced and complex instrumentation, without which it is very difficult to get acceptable results. It must be kept in mind, however, that in the majority of Latin American and Caribbean countries and cities the number of motor vehicles is still low and probably insufficient to produce a generalized problem. Nevertheless, traffic in the downtown areas of many cities is already heavy enough to produce high pollutant concentrations, situation which is aggravated by the fact that many of the vehicles in use are comparatively old models and not always in good repair. This is a situation that should be carefully observed and monitored. PAHO hopes to be able to include methods to measure these pollutants in the REDPANAIRE Manual of Operations in the near future. To implement them the countries will have to assign more financial resources to their monitoring and evaluation programs than those allotted in the past.

4. REPRESENTATIVITY OF SAMPLES

According to the instructions in the REDPANAIRE Manual of Operations[3], the first station in each city should be located in the downtown area, corresponding normally to places with heavy vehicle traffic, a predominance of administrative offices and commercial establishments, and little industrial activity. When there are more than one station in the same city, they have been distributed in such a manner as to cover different types of zones - industrial, residential, commercial - in order to get the most representative picture possible. It should be kept in mind that this is not a simple task. Horizontal and vertical air currents diffuse and disperse pollutants, both in time and space, in a very unpredictable manner. Concentrations measured at a specific place and time can change considerably - increasing or decreasing - in a matter of minutes. The form and rhythm of emission production are also important factors. To ameliorate these variations REDPANAIRE uses daily and monthly averages, which is a normal practice in most monitoring programs throughout the world. Although they do not provide information about instantaneous peaks that may occur, they give weighted averages which lessen the differences.

It can be assumed that results from one station constitute a reasonable representation of what is happening within a radius of approximately one kilometer, providing there are no sources of pollutants in the near vicinity to distort the results. The results also provide some information about conditions within a radius of approximately five kilometers around the station, with precision varying in inverse relation to distance. When there are several stations operating in one city, similar results obtained at two of them can mean that concentrations are fairly constant in the zone between the sampling sites.

To get really representative samples of the atmosphere of a city is a complex task that can be costly. The first REDPANAIRE-type station installed in a city costs at present around US$1 500 including equipment and materials for a year of analysis. Additional stations, for which it is not necessary to duplicate the elements for analysis of samples, cost approximately US$800. Cost of materials for a year of operations reaches US$200. However, an extensive evaluation program implies additional expenses, including the cost of station operation, personnel and vehicles for collecting samples, laboratories, administration, etc. A truly representative program can mean a considerable number of stations and personnel to run them. For this reason, a suitable compromise needs to be found between the desirability of obtaining the best possible knowledge and a reasonable cost. Five to eight REDPANAIRE-type stations, which can be installed with an investment of US$5 000 to 6 500, and run with a total operational cost of US$10 000 per year, can give a sufficiently clear picture in a city of 500 000 to 1 000 000 inhabitants, if they are located in such a manner that they supply information on the different types of zones within the city. Logically, this number should be increased, although not proportionally, for larger cities. One station alone should be considered representative only of the situation at the site where it is installed and in the immediate neighborhood.

5. INTERPRETATION OF RESULTS

There is not yet enough knowledge to establish precisely what should be considered as a clean atmosphere, nor is there agreement in this respect between specialists and researchers or among national and international authorities. The U.S. Environmental Protection Agency recently published a compilation of air quality management standards from all over the world[4], which shows a wide diversity in relation to values considered as acceptable. Among the better known are those approved by the United States in 1971, published in the Federal Register[5], and those in force in the U.S.S.R. since 1951.[6]

At the international level, the World Health Organization (WHO) proposed in 1972[7] some figures referred to as Recommended Long-Term Goals, which are gradually becoming known. REDPANAIRE, in turn, had already suggested in 1967 Reference Levels[1] to facilitate interpretation of results obtained. In Table 2 a summary of these four sets of acceptable limits is presented. It is easy to see a relatively important variation, both in the accepted levels and the sampling and analytical techniques. However, the values are of similar magnitude.

Given these circumstances, and to maintain uniformity with previous reports, the data for this report has been summarized in several tables in which, for comparison purposes, the REDPANAIRE Reference Levels are used. In most cases, the WHO Long-Term Goals are also indicated. As mentioned in the first Network Report[1]: *"These figures do not attempt to set international limits, a function beyond the scope of an isolated institution. Their only purpose is to establish a comparison basis which will help to determine,*

Table 2

Air quality standards proposed by the Soviet Union, the United States and WHO for suspended dust and sulfur dioxide

(μg/m³)

	U.S.S.R. (1951)	U.S.A. (1971)	WHO REDPANAIRE (1967)	WHO Expert Committee (1972)
Suspended dust:				
Annual average	---	75[a, b]	100[c]	40[c]
Daily average	150	260[b, d]	---	--
Maximum one-time concentration	500	---	---	--
98% of observations below	---	---	---	120[c]
Sulfur dioxide:				
Annual average	---	80[e]	70[c]	60[c]
Daily average	50	365[e, d]	--	--
Maximum one-time concentration	500	---	--	--
98% of observations below	---	---	--	200[c]

Notes:

(*a*) Geometric mean

(*b*) Analyzed by the high-volume method

(*c*) Analyzed by the methods used by the REDPANAIRE

(*d*) Not to be exceeded more than once per year

(*e*) Analyzed by the pararosaniline colorimetric method *even if only approximately, the quality of ambient air in a city as a function of results obtained by the Network stations. It must be clearly understood that they only claim to be reference levels for comparison among monthly averages of samples collected and analyzed by the Network stations. Air will be polluted to the extent to which mean figures are higher than these concentrations. Similarly, if they are lower, the problem should be considered less serious according to how far the monthly averages are from the reference levels. The trend of these means, when it can be determined, will be the most important observation. A tendency towards periodic increase will indicate the urgency of adopting prevention and control measures to avoid greater deterioration of air quality and to try to correct the existing situation."*

6. PRECISION OF SAMPLING AND ANALYSIS

Precision of results obtained by methods used in any measuring program, even those employing instrumental techniques and high-priced equipment, is controversial. The complex problem of determining very low concentrations, which are constantly changing both in space and time, makes it difficult to get precise results showing the exact conditions prevalent in a specific city or zone. No really good analytical methods are available for practically any of the most important pollutants. Under these circumstances, we have to compromise by accepting reasonable approximations.

The best methods for measuring settled dust have been discussed at length in numerous papers. Different programs use diverse types of jars, with variations in height, weight, shape and material. Sampling techniques are equally different. Since this method is basically of an empiric nature, in REDPANAIRE an intent has been made to carefully standardize sampling and analysis and the shape of the collecting jar in order to prevent losses and get the most uniform and comparable results possible.

With reference to suspended particles, divergencies are even greater, since they affect the technical basis of sampling and analysis as well. The most common method in the United States uses a gravimetric technique and a high-volume vacuum pump. The one most used in England, Europe, and several other countries of the world, suggested by WHO as the standard method for its Long-Term Goals, is based on collecting the particles suspended in a relatively low volume of air on a white filter paper. Since not enough material is collected for a gravimetric measurement, concentration is estimated by means of the loss of reflectivity caused by the dust stain.

Both methods have advantages and disadvantages. The size of particles collected by the high-volume sampler depends fundamentally on the air flow rate, which is, in turn, a function of the power of the motor and the structure and dimensions of the instrument. Air velocity and, as a consequence, the size of the particles that can be collected diminish considerably as dust is deposited on the filter. The larger particles are precisely the most difficult ones to capture and have the biggest influence on the total mass. It must be kept in mind that weight varies with the third power of the particle diameter. In addition, a large chamber where the relative humidity can be kept at 55% or less is needed for the gravimetric analysis.

The reflectometric method has, on the other hand, the serious disadvantage of being dependent, to a great extent, on particle color. Cities with heavy smoke produce darker stains, giving positive systematic errors. Very light particles, like some natural dust and cement, can cause important negative errors. It must also be kept in mind that "suspended dust" is not a specific chemical entity, but a mixture of many substances produced by different sources and causes, their common characteristics being a solid state and a relatively wide range of particulate size, normally less than 50 μm in diameter.

A broader discussion of the precision of the method used by REDPANAIRE for suspended dust does not seem possible. A method has been adopted, as empiric as the others, which when used under strictly standardized conditions yields perfectly valid results within a specific station. This validity may not extend to the comparison among different stations, because the characteristics of suspended particles can change from one city to another, and even within the same city from one zone to another or for different periods of the year. A similar situation occurs with the gravimetric method. The most important fact is that continuous and around-the-clock measurement will make it possible to establish, over a period of time, concentration trends, the seriousness of the problem affecting a city, the urgency of adopting prevention and control measures and the results of control programs when these are in operation.

The situation is different, although not much better, with respect to sulfur dioxide. Of course, this corresponds to a perfectly defined chemical compound - SO_2 - with well-known chemical and physical properties. However, permissible limits are all on the order of three parts of sulfur dioxide per 100 millions parts of air. These low concentrations, together with possible interferences, make its analysis quite difficult.

The precision of the hydrogen peroxide method has been the subject of studies by CEPIS and by national institutions.[8] These tests show that recuperation is approximately 82%, which is not affected by any of the variables studied. A modification made by one of the countries, completing the analysis by means of turbidimetry with previous precipitation as barium sulfate, produced somewhat better recuperation without a substantial variation in the average values obtained.[9] A comparative study made at CEPIS by means of parallel samples analyzed by the hydrogen peroxide and the pararosaniline (West & Gaeke) methods again gave similar averages, with differences of less than 10%, which should be considered satisfactory. In one of the cities it was decided to change the sampling and analytical techniques from the hydrogen peroxide to the pararosaniline method. No important differences were observed in the magnitude of the results obtained. In another, collection in sodium hydroxide and volumetric analysis of the sodium sulfite obtained did not have a significant effect on the results. The studies made show that agencies forming part of the REDPANAIRE, using the sampling and analytical method suggested in its Manual of Operation, developed in England, utilized in many other countries, and proposed by a WHO Expert Committee as the basis of its Long-Term Goals, can be reasonably satisfied about the precision of results obtained, especially with reference to the validity of averages and observed trends.

7. PARTICIPATING CITIES

Table 3 lists the cities participating in the program which submitted results to CEPIS before the deadline for their inclusion in this report. As it can be seen, samples taken at 93 stations, installed in 29 cities of 14 countries have been analyzed. REDPANAIRE is constantly expanding and in the future it will be possible to offer a more complete view of the situation in the Region.

8. GENERAL DISTRIBUTION OF RESULTS

The 93 stations included in this report collected 151 553 samples, of which 1.7% correspond to settled dust, 50.4% to suspended dust, and 47.9% to sulfur dioxide samples.

In Table 4 a distribution of results is presented. In Part A, data are classified according to pollutants analyzed, showing the number and percentage of samples exceeding the values suggested as Reference Levels (R.L.). Taken as a whole, 26.4% of all samples exceeded these levels. These percentages vary for each pollutant. Thus, 75.7% of the settled dust samples, 22.9% of suspended dust, and 28.2% of sulfur dioxide exceeded the suggested values.

This excess was quite great in some cases. Table 4B presents a distribution of the general averages for each pollutant, according to the number and percentage of stations with results reaching one half, one, or more times the Reference Levels. As can be seen, excesses are found particularly in the case of settled dust. Only 3.7% of the stations have a general average below one half the Reference Level (<0.5 R.L.), a concentration that can be considered satisfactory. A general average between one half and one time the Reference Level, still acceptable, is shown by 18.5% of the stations. The other 63 stations, 77.8% of the total, had averages over the Reference Level. Eight stations (9.9%) had general averages between 5.1 and 10 times the Reference Level, and one station (1.2%) exceeds this figure by more than 10 times. Since this is the general average of all samples analyzed, this reflects a serious condition to which due consideration should be given.

The situation is somewhat better, but not satisfactory, for the other pollutants. For suspended dust, 48.9% of the stations have a general average below one half the Reference Level and 32.6% are included between one half and one time this level; in other words, they have good or acceptable atmospheric conditions for this pollutant. Only 15 stations (16.3%) showed general averages between one and two times the Reference Level, and two stations (2.2%) had between two and three times this figure. Since suspended particles constitute the material that is inhaled into the respiratory system of the inhabitants of the corresponding cities, these figures cannot be considered satisfactory. If we compare them with the Long-Term Goal (L.T.G.) proposed by WHO, the situation is much worse.

Table 3

REDPANAIRE (1967-1974)

Distribution of sampling stations included in the Network with results up to December 1974 contained in this report

Country	City	No. of stations	No. of results
Argentina	Buenos Aires	6	7 174
	Cordoba	2	3 212
	Mendoza	3	1 751
	Rosario	1	290
Bolivia	La Paz	1	1 730
Brasil	Belo Horizonte	1	783
	Curitiba	1	284
	Porto Alegre	1	3 147
	Rio de Janeiro	1	2 760
	São Paulo	11	8 237
Colombia	Barranquilla	3	2 528
	Bogota	6	12 178
	Bucaramanga	1	1 811
	Cali	4	2 083
	Cartagena	1	258
	Medellin	4	7 523
Costa Rica	San Jose	1	1 822
Cuba	Holguin	1	471
	Havana	6	8 987
	Santiago de Cuba	2	657
Chile	Santiago	2	6 331
El Salvador	San Salvador	2	2 739
Guatemala	Guatemala	1	1 014
Jamaica	Kingston	1	736
Mexico	Mexico City	14	44 290
Peru	Lima	4	7 688
Uruguay	Montevideo	2	2 708
Venezuela	Caracas	8	17 960
	Maracaibo	2	401
14	29	93	151 553

Table 4

REDPANAIRE (1967 - 1974)

Distribution of results obtained

A. By pollutant analyzed, showing total and percentage of samples exceeding values proposed as Reference Levels (R.L.)

Pollutant	No. of stations	Total of samples	%	> R.L.	
				No.	%
Settled dust	81	2 585	1.7	1 957	75.7
Suspended dust	92	76 343	50.4	17 518	22.9
Sulfur dioxide	93	72 625	47.9	20 485	28.2
		151 553	100.0	39 960	26.4

B, Distribution of the general average for each pollutant showing the number and percentage of stations with results between specific multiples of the respective Reference Levels

R.L.	Settled dust		Suspended dust		Sulfur dioxide	
	No. stations	%	No. stations	%	No. stations	%
< 0,5	3	3.7	45	48.9	55	59.1
0,5-1	15	18.5	30	32,6	14	15.1
1,1-2	26	32,1	15	16,3	22	23,7
2,1-3	15	18,5	2	2.2	2	2,1
3,1-4	8	9,9	92	100.0	93	100.0
4,1-5	5	6,2				
5,1-10	8	9,9				
>	1	1,2				
	81	100.0				

With relation to sulfur dioxide, 55 stations (59.1%) are below one half the Reference Level and another 14 (15.1%) are included between one half and one time this figure. Twenty-two stations (23.7%) showed general averages between one and two times this suggested level, and two stations (2.1%) between two and three times this figure. Sulfur dioxide is probably a more dangerous pollutant than suspended dust, and there are a greater number of stations with excessive general averages. This should alert the health authorities to the need for implementing corrective measures.

9. SETTLED DUST

Table 5 presents the network stations in decreasing order of the arithmetic mean of the monthly results collected. The first 14 general averages, which include seven stations in Mexico City, two in Barranquilla, and one each in Curitiba, Cartagena, Medellin, Cordoba, and Montevideo, are over four times the value suggested as the Reference Level. Values over twice the Reference Level were found at the 14 stations of Mexico City, including those installed in the cleanest zones.

At the lower end of the table, the 18 stations with concentrations equal or lower than the Reference Level are found in Caracas, Lima, Santiago de Cuba, Maracaibo, and other cities which seem to still have an atmosphere reasonably free of large particles. Those with general averages very near the Reference Level should increase their sampling programs to try to get a better knowledge of the real situation affecting them, and adopt immediately the necessary preventive steps to maintain, and if possible to improve, this situation.

Table 6 presents the network stations in decreasing order of the maximum monthly average obtained at each station, showing the month and year when this value appeared. Here some figures can be found which may not correspond to reality and, unless confirmed by other data, could have been caused by a sampling or analytical failure. The maximum value reported for the whole network, 38.4 $mg/cm^2/30$ days, was obtained at Barranquilla 1 in October 1971. This would represent an extreme situation in which 384 tons of dust would have settled over an area of one km^2 around this station during the month. Maximum values over 10 $mg/cm^2/30$ days have also been found at Cartagena 1 and Montevideo 1. These too should be considered as excessive although they are far below Barranquilla 1. However, these samples cannot be ignored under the unconfirmed assumption that they are erroneous. Another look at the table shows that the other stations in Barranquilla are in 5th and 21st place in decreasing order, and that the maximum value obtained in the latter is still almost ten times above the Reference Level. Every precaution should be taken to be sure that sampling and analysis leave no doubts as to the quality of results, and to investigate the cause of these high concentrations, their consequences for the population, and the best way to correct them.

The maximum values for most of the stations in Mexico City are in the upper part of the table. Other cities, among them Havana, Medellin, Cali, Cordoba, and Curitiba, also show high values.

Table 5

REDPANAIRE - SETTLED DUST (1967 - 1974)

Network stations in decreasing order of the arithmetic mean of monthly results ($mg/cm^2/30$ days)

	Station	General average	No. of monthly samples
1.	Barranquilla 1	6.77	24
2.	Curitiba 1	4.80	5
3.	Mexico 2	4.30	68
4.	Cartagena 1	4.08	7
5.	Mexico 3	3.54	70
6.	Medellin 2	3.45	36
7.	Barranquilla 2	2.72	30
8.	Mexico 12	2.57	13
9.	Mexico 11	2.55	31
10.	Cordoba 2	2.35	22
11.	Mexico 14	2.26	9
12.	Mexico 1	2.13	71
13.	Montevideo 1	2.12	29
14.	Mexico 10	2.02	43
15.	Mexico 5	1.94	66
16.	Buenos Aires 4	1.82	9
17.	Cordoba 1	1.80	38
18.	Mexico 7	1.71	56
19.	Cali 2	1.71	14
20.	Bogota 3	1.58	7
21.	Mexico 4	1.56	68
22.	Caracas 1	1.53	61
23.	Barranquilla 3	1.37	18
24.	Belo Horizonte 1	1.34	34
25.	Mexico 6	1.33	55
26.	Mexico 9	1.31	47
27.	Mexico 8	1.30	54
28.	Cali 1	1.30	13
29.	Bogota 1	1.28	80
30.	São Paulo 1	1.28	66
31.	Buenos Aires 1	1.24	68
32.	Guatemala 1	1.23	17
33.	La Habana 11	1.20	7
34.	Medellin 3	1.18	30
35.	Medellin 4	1.14	32
36.	Mexico 13	1.09	9
37.	Buenos Aires 2	1.07	14
38.	Porto Alegre 1	0.98	52
39.	Cali 3	0.97	12
40.	Caracas 4	0.96	44
41.	La Habana 5	0.93	19
42.	Bogota 5	0.90	32
43.	Medellin 1	0.87	21
44.	Bogota 2	0.85	30
45.	San Salvador 2	0.85	17
46.	La Habana 3	0.84	22
47.	Rosario 1	0.82	6
48.	La Habana 6	0.77	20
49.	Buenos Aires 3	0.76	10
50.	Santiago 1	0.72	53
51.	La Habana 1	0.70	56
52.	Caracas 8	0.69	18
53.	Montevideo 2	0.69	17
54.	Kingston 1	0.69	15
55.	Rio de Janeiro 1	0.68	86
56.	La Paz 1	0.64	27
57.	San Salvador 1	0.63	46
58.	Bucaramanga 1	0.61	38
59.	Caracas 7	0.61	22
60.	Bogota 4	0.58	32
61.	Caracas 5	0.54	36
62.	Mendoza 1	0.54	15
63.	Santiago 2	0.53	6
64.	Lima 4	0.50 --R.L.	27
65.	Lima 1	0.49	68
66.	Caracas 6	0.48	26
67.	Mendoza 9	0.48	12
68.	La Habana 2	0.47	42
69.	Caracas 2	0.45	59
70.	Caracas 3	0.43	60
71.	Cali 4	0.43	10
72.	Mendoza 2	0.42	37
73.	Holguin 1	0.41	9
74.	Maracaibo 1	0.41	4
75.	Bogota 6	0.40	31
76.	Santiago de Cuba 1	0.38	11
77.	San Jose 1	0.36	34
78.	Lima 3	0.30	39
79.	Santiago de Cuba 2	0.22	2
80.	Lima 2	0.21	36
81.	Maracaibo 2	0.17	5

Table 6

REDPANAIRE - SETTLED DUST (1967 - 1974)

Network stations in decreasing order of the maximum monthly value obtained in each station, indicating the month this maximum value occurred ($mg/cm^2/30$ days)

	Station	Month	Maximum monthly value
1.	Barranquilla 1	Oct 71	38.40
2.	Cartagena 1	Feb 74	18.73
3.	Montevideo 1	Feb 71	12.14
4.	Mexico 4	Set 71	8.81
5.	Barranquilla 2	Set 72	8.70
6.	Mexico 2	Dic 70	8.51
7.	Mexico 3	Jun 70	8.06
8.	Medellin 2	Abr 74	7.77
9.	La Habana 5	Jun 74	7.77
10.	La Habana 3	Jul 74	7.40
11.	Cali 2	Set 71	7.25
12.	Cordoba 2	Dic 71	6.72
13.	Curitiba 1	Jun 74	6.59
14.	Mexico 11	Mar 73	5.88
15.	Mexico 10	May 70	5.85
16.	La Habana 6	Mar 74	5.78
17.	Rio de Janeiro 1	Abr 71	5.60
18.	Cordoba 1	Ene 72	5.41
19.	Mexico 1	Mar 73	5.08
20.	Mexico 12	May 73	4.92
21.	Barranquilla 3	Abr 73	4.80
22.	Mexico 5	May 73	4.40
23.	Buenos Aires 1	Ago 67	4.10
24.	Mexico 14	May 73	3.94
25.	Santiago 1	Mar 69	3.92
26.	Caracas 1	Jun 72	3.85
27.	Mexico 7	Feb 72	3.75
28.	Belo Horizonte 1	Set 73	3.29
29.	Mexico 6	Jun 73	3.25
30.	La Habana 2	Jun 73	3.00
31.	Mexico 8	Abr 72	2.93
32.	Bogota 6	Nov 72	2.87
33.	Bogota 3	Mar 74	2.65
34.	Cali 1	Ago 71	2.57
35.	Mexico 9	May 70	2.56
36.	Buenos Aires 4	Oct 70	2.55
37.	Medellin 3	May 72	2.52
38.	Guatemala 1	Ago 73	2.49
39.	Mexico 13	May 73	2.48
40.	Cali 3	Mar 72	2.41
41.	Bogota 5	May 73	2.40
42.	Kingston 1	Mar 69	2.39
43.	La Habana 11	Jun 74	2.28
44.	Buenos Aires 2	Set 67	2.27
45.	Medellin 4	Ene 72	2.14
46.	Porto Alegre 1	Ene 72	2.08
47.	São Paulo 1	Ene 72	2.07
48.	Bogota 2	Ene 73	2.03
49.	Caracas 4	Oct 73	1.94
50.	Bogota 1	Mar 71	1.91
51.	Mendoza 2	Dic 70	1.78
52.	San Salvador 1	Dic 74	1.46
53.	Caracas 8	Abr 74	1.41
54.	La Habana 1	Jun 72	1.40
55.	San Salvador 2	May 74	1.38
56.	Rosario 1	Jun 71	1.36
57.	Montevideo 2	Ene 74	1.26
58.	Medellin 1	Oct 73	1.20
59.	Bucaramanga 1	Oct 71	1.19
60.	Buenos Aires 3	Ago 69	1.15
61.	La Paz 1	Jun 73	1.12
62.	Mendoza 1	Ene 71	1.00
63.	Cali 4	May 74	0.97
64.	Caracas 5	May 74	0.97
65.	Caracas 2	Oct 74	0.95
66.	Caracas 7	May 74	0.93
67.	Caracas 3	Ago 73	0.86
68.	Bogota 4	Mar 72	0.82
69.	Mendoza 9	Dic 73	0.80
70.	Lima 4	Nov 71	0.91
71.	San Jose 1	May 73	0.78
72.	Lima 1	Abr 71	0.77
73.	Caracas 6	Jun 73	0.75
74.	Santiago 2	Abr 69	0.71
75.	Holguin 1	May 74	0.57
76.	Santiago de Cuba 1	May 74	0.53
77.	Lima 3	Ago 72	0.51
78.	Maracaibo 1	Mar 74	0.51
			------ R.L.
79.	Lima 2	Ene 73	0.49
80.	Maracaibo 2	Feb 74	0.24
81.	Santiago de Cuba 2	Dic 74	0.22

In Table 7 the results for settled dust are presented according to the percentage of values exceeding the Reference Level. Since such high figures have been found for this pollutant, it was decided to calculate also the number and percentage of samples exceeding 1 mg/cm^2/30 days; i.e. twice the Reference Level. Six stations, three of them in Mexico City, reported 100% of their samples exceeding twice the Reference Level. The others are Medellin 2, Buenos Aires 4 and Curitiba 1. At another 15 stations, 100% of the samples are over the Reference Level, but the percentages exceeding twice this value are a little lower. At the bottom of the table only three stations - Lima 2, Maracaibo 2, and Santiago de Cuba 2 - had all their results below the Reference Level.

In analyzing the previously mentioned figures, the number of samples taken should be kept in mind. Of course, averages obtained as a result of a large amount of data are much more valid than those corresponding to only a few samples. Continuity and expansion of measurement programs will show if data collected in the future confirm the preliminary analysis or if they indicate a need to revise these conclusions.

The samples of settled dust taken in each of the 29 cities included in the REDPANAIRE are grouped by city and presented in Table 8 in decreasing order of the percentage of those exceeding the Reference Level. In six cities (20.7%), 100% of the samples are over this figure, and in another six over 90% exceeds these values. At the end of the table there is no city where all samples are below the Reference Level, although in five cities (17.2%) - Holguín, Lima, San Jose, Maracaibo, and Santiago de Cuba - 100% of results are lower than 1 mg/cm^2/30 days, or twice the Reference Level.

10. SUSPENDED DUST

The 92 stations which collected suspended dust samples are presented in Table 9 in decreasing order of the arithmetic mean of the monthly averages of the concentrations observed at each one of them. Seventeen stations (18.5%) show general averages in excess of the Reference Level. At one of them, Mendoza 9, this general average reaches 300 μg/m^3, three times the proposed Reference Level and 7.5 times the Long-Term Goal (L.T.G.) recommended by WHO. If the WHO L.T.G. is used as a reference, 53 stations (57.6%) have averages over 40 μg/m^3.

At the other end 45 stations (48.9%) have general averages below one half the Reference Level, and 38 (41.3%) of them are below the L.T.G. This represents an acceptable condition that should be confirmed by continuous monitoring and should be improved, or at least preserved, by opportunely developing the necessary prevention and control programs.

In Table 10 the stations are distributed in decreasing order of the maximum monthly average obtained at each of them, indicating the month this maximum average occurred. The highest value was observed at Havana 6, October 1973, with 428 μg/m^3. It is followed by stations in Sao Paulo, Mendoza, Buenos Aires, San Salvador and Mexico City, all of them with maximum values over three times the Reference Level. Forty-four stations

Table 7

REDPANAIRE - SETTLED DUST (1967 - 1974)

Network stations in decreasing order of the percentage of total samples exceeding the proposed Reference Level of 0.5 $mg/cm^2/30$ days

Station	Samples	> 0.5		> 1.0	
		N°	%	N°	%
1. Medellin 2	36	36	100.0	36	100.0
2. Mexico 11	31	31	100.0	31	100.0
3. Mexico 12	13	13	100.0	13	100.0
4. Mexico 14	9	9	100.0	9	100.0
5. Buenos Aires 4	9	9	100.0	9	100.0
6. Curitiba 1	5	5	100.0	5	100.0
7. Mexico 3	70	70	100.0	68	97.1
8. Cordoba 1	38	38	100.0	34	89.5
9. Barranquilla 1	24	24	100.0	21	87.5
10. Barranquilla 2	30	30	100.0	26	86.7
11. Mexico 1	71	71	100.0	59	83.1
12. Montevideo 1	29	29	100.0	23	79.3
13. Caracas 1	61	61	100.0	47	77.0
14. São Paulo 1	66	66	100.0	49	74.2
15. Bogota 3	7	7	100.0	5	71.4
16. Cali 1	13	13	100.0	9	69.2
17. Guatemala 1	17	17	100.0	11	64.7
18. La Habana 11	7	7	100.0	4	57.1
19. Barranquilla 3	18	18	100.0	10	55.6
20. Porto Alegre 1	52	52	100.0	22	42.3
21. Rosario 1	6	6	100.0	1	16.7
22. Bogota 1	80	79	98.7	64	80.0
23. Mexico 2	68	67	98.5	62	91.2
24. Mexico 7	56	55	98.2	52	92.8
25. Belo Horizonte 1	34	33	97.1	23	67.6
26. Mexico 5	66	64	97.0	58	87.9
27. Medellin 4	32	31	96.9	22	68.8
28. Bogota 5	32	31	96.9	7	21.9
29. Medellin 3	30	29	96.7	21	70.0
30. Mexico 8	54	52	96.3	39	72.2
31. Mexico 9	47	45	95.7	32	68.1
32. Cordoba 2	22	21	95.5	19	86.4
33. Mexico 10	43	41	95.3	41	95.3
34. Medellin 1	21	20	95.2	6	28.6
35. Mexico 6	55	52	94.5	40	72.7
36. Mexico 4	68	64	94.1	48	70.6
37. Buenos Aires 1	68	64	94.1	44	64.7
38. Bogota 2	30	28	93.3	9	30.0
39. Cali 2	14	13	92.9	9	64.3
40. Buenos Aires 2	14	13	92.9	5	35.7
41. Caracas 7	22	20	90.9	0	0.0
42. Buenos Aires 3	10	9	90.0	1	10.0
43. Mexico 13	9	8	88.9	4	44.4
44. Caracas 4	44	39	88.6	20	45.5
45. San Salvador 2	17	15	88.2	4	23.5
46. Cali 3	12	10	83.3	6	50.0
47. Caracas 8	18	15	83.3	2	11.2
48. Montevideo 2	17	13	76.5	3	17.6
49. La Habana 1	56	42	75.0	10	17.9
50. Bogota 4	32	23	71.9	0	0.0
51. Cartagena 1	7	5	71.4	3	42.9
52. Bucaramanga 1	38	27	71.1	2	6.3
53. San Salvador 1	46	31	67.4	4	8.7
54. La Paz 1	27	18	66.7	1	3.7
55. Santiago 1	53	34	64.2	6	11.3
56. La Habana 5	19	11	57.9	2	10.5
57. Rio de Janeiro 1	86	47	54.7	5	5.8
58. La Habana 3	22	12	54.5	3	13.6
59. Caracas 5	36	19	52.8	0	0.0
60. Santiago 2	6	3	50.0	0	0.0
61. Lima 1	68	30	44.1	0	0.0
62. La Habana 6	20	8	40.0	3	15.0
63. Mendoza 1	15	6	40.0	0	0.0
64. Caracas 6	26	10	38.5	0	0.0
65. Kingston 1	15	5	33.3	2	13.3
66. Lima 4	27	9	33.3	0	0.0
67. Mendoza 9	12	4	33.3	0	0.0
68. Holguin 1	9	3	33.3	0	0.0
69. Caracas 2	59	18	30.5	0	0.0
70. Cali 4	10	3	30.0	0	0.0
71. Caracas 3	60	15	25.0	0	0.0
72. Maracaibo 1	4	1	25.0	0	0.0
73. Mendoza 2	37	8	21.6	3	8.1
74. La Habana 2	42	9	21.4	1	2.4
75. Bogota 6	31	6	19.4	1	3.3
76. San Jose 1	34	5	14.7	0	0.0
77. Santiago de Cuba 1	11	1	9.1	0	0.0
78. Lima 3	39	1	2.6	0	0.0
79. Lima 2	36	0	0.0	0	0.0
80. Maracaibo 2	5	0	0.0	0	0.0
81. Santiago de Cuba 2	2	0	0.0	0	0.0
	2 585	1 957	75.7	1 179	45.6

Table 8

REDPANAIRE - SETTLED DUST (1967 - 1974)

Cities included in the Network in decreasing order of the percentage of total samples exceeding the proposed Reference Level of 0.5 $mg/cm^2/30$ days

City	Stations in city	Total samples	Samples exceeding 0.5		Samples exceeding 1.0	
			No.	%	No.	%
1. Curitiba	1	5	5	100.0	5	100.0
2. Barranquilla	3	72	72	100.0	57	79.2
3. São Paulo	1	66	66	100.0	49	74.2
4. Guatemala	1	17	17	100.0	11	64.7
5. Porto Alegre	1	52	52	100.0	22	42.3
6. Rosario	1	6	6	100.0	1	16.7
7. Cordoba	2	60	59	98.3	53	88.3
8. Medellin	4	119	116	97.5	85	71.4
9. Mexico City	14	660	642	97.3	556	84.2
10. Belo Horizonte	1	34	33	97.1	23	67.6
11. Buenos Aires	4	101	95	94.1	59	58.4
12. Montevideo	2	46	42	91.3	26	56.5
13. Bogota	6	212	174	82.1	86	40.6
14. Cali	4	49	39	79.6	24	49.0
15. San Salvador	2	63	46	73.0	8	12.7
16. Cartagena	1	7	5	71.4	3	42.9
17. Bucaramanga	1	38	27	71.1	2	5.3
18. La Paz	1	27	18	66.7	1	3.7
19. Santiago	2	59	37	62.7	6	10.2
20. Caracas	8	326	197	60.4	69	21.2
21. Rio de Janeiro	1	86	47	54.7	5	5.8
22. Havana	6	166	89	53.6	23	13.9
23. Kingston	1	15	5	33.3	2	13.3
24. Holguin	1	9	3	33.3	0	0.0
25. Mendoza	3	64	18	28.1	3	4.7
26. Lima	4	170	40	23.5	0	0.0
27. San Jose	1	34	5	14.7	0	0.0
28. Maracaibo	2	9	1	11.1	0	0.0
29. Stgo. de Cuba	2	13	1	7.7	0	0.0
	81	2 585	1 957	75.7	1 179	45.6

Table 9

REDPANAIRE - SUSPENDED DUST (1967 - 1974)

Network stations in decreasing order of the arithmetic mean of the monthly average concentrations ($\mu g/m^3$)

	Station	Monthly average	No. of monthly averages		Station	Monthly average	No. of monthly averages
1.	Mendoza 9	300.0	12	47.	São Paulo 9	52.0	10
2.	San Salvador 2	291.3	18	48.	La Habana 6	47.8	19
3.	Montevideo 2	179.5	17	49.	Medellin 4	45.4	34
4.	Buenos Aires 1	174.7	72	50.	Buenos Aires 3	44.3	11
5.	Mexico 6	168.7	65	51.	São Paulo 11	43.1	10
6.	Buenos Aires 2	154.5	18	52.	Guatemala 1	42.8	19
7.	São Paulo 1	150.4	67	53.	Bogota 2	42.6	28
8.	Rosario 1	133.9	8	54.	Bogota 4	40.0 --L.T.G.	32
9.	Mexico 3	132.5	78	55.	Cali 1	38.1	23
10.	La Habana 2	131.1	48	56.	Medellin 1	36.8	37
11.	La Habana 1	118.2	58	57.	La Paz 1	36.8	29
12.	São Paulo 7	116.9	10	58.	San Jose 1	36.1	31
13.	Buenos Aires 4	108.4	9	59.	Mendoza 1	34.1	14
14.	Mexico 1	107.5	80	60.	Kingston 1	33.3	22
15.	San Salvador 1	104.9	46	61.	Bogota 5	32.8	32
16.	São Paulo 2	104.7	12	62.	La Habana 5	31.7	18
17.	Mexico 2	100.4	75	63.	Lima 1	30.8	68
18.	Mexico 12	96.9 R.L.	16	64.	Cali 2	29.8	24
19.	Mexico 11	95.3	39	65.	Cali 3	29.2	23
20.	Mexico 10	93.8	51	66.	La Habana 3	26.6	19
21.	São Paulo 10	89.8	10	67.	Caracas 7	25.4	22
22.	Mexico 8	88.0	62	68.	Caracas 8	25.4	19
23.	Mexico 14	87.7	17	69.	Barranquilla 2	24.7	30
24.	Mexico 7	86.9	64	70.	Mendoza 2	24.6	37
25.	Rio de Janeiro 1	84.1	84	71.	Caracas 4	22.7	48
26.	Santiago 1	83.6	82	72.	Porto Alegre 1	22.2	52
27.	Montevideo 1	83.1	36	73.	Caracas 6	20.5	27
28.	Santiago 2	81.8	31	74.	La Habana 11	21.4	7
29.	São Paulo 4	80.3	11	75.	São Paulo 8	18.1	10
30.	Buenos Aires 23	77.3	24	76.	Lima 4	18.0	28
31.	Mexico 4	75.0	77	77.	Caracas 2	17.2	62
32.	Medellin 2	74.9	35	78.	Bucaramanga 1	16.6	40
33.	Caracas 1	73.4	64	79.	Cartagena 1	16.5	14
34.	Bogota 3	73.3	7	80.	Barranquilla 3	16.3	21
35.	São Paulo 6	70.8	10	81.	Caracas 3	15.8	67
36.	Mexico 5	67.0	75	82.	Lima 3	15.6	34
37.	Cordoba 1	66.0	41	83.	Caracas 5	14.4	38
38.	Cordoba 2	64.3	25	84.	Santiago de Cuba 1	13.4	11
39.	Buenos Aires 22	64.3	8	85.	Bogota 6	13.0	30
40.	Mexico 13	63.7	17	86.	Cali 4	12.8	3
41.	Bogota 1	59.5	81	87.	Holguin 1	11.3	9
42.	Curitiba 1	59.4	5	88.	Maracaibo 1	11.1	5
43.	São Paulo 5	59.1	11	89.	Lima 2	10.2	34
44.	Medellin 3	58.2	38	90.	Maracaibo 2	8.4	5
45.	Mexico 9	56.8	56	91.	Santiago de Cuba 2	6.9	2
46.	São Paulo 3	55.6	11	92.	Barranquilla 1	6.0	23

Table 10

REDPANAIRE - SUSPENDED DUST (1967 - 1974)

Network stations in decreasing order of the maximum monthly average obtained at each station, with indication of the month when this maximum average occurred ($\mu g/m^3$)

	Station	Month	Maximum monthly average
1.	La Habana 6	Oct 73	428
2.	São Paulo 1	Jun 72	393
3.	Mendoza 9	Ago 73	385
4.	Buenos Aires 1	Ago 72	351
5.	San Salvador 2	Jul 74	339
6.	Mexico 6	Ene 73	314
7.	La Habana 2	Feb 73	274
8.	Montevideo 2	Abr 74	254
9.	Mexico 3	Dic 70	254
10.	Buenos Aires 4	Jun 70	253
11.	Cordoba 2	May 71	247
12.	Santiago 1	Jun 67	242
13.	Mexico 2	Ene 72	241
14.	Buenos Aires 2	May 68	230
15.	Rio de Janeiro 1	Jun 70	224
16.	Mexico 1	Ene 73	222
17.	Mexico 10	Ene 73	221
18.	Mexico 8	Ene 72	219
19.	Santiago 2	Jul 68	209
20.	Mexico 11	Dic 74	206
21.	San Salvador 1	Ene 72	193
22.	Cordoba 1	Jul 71	185
23.	La Habana 1	Set 73	169
24.	Mexico 14	Ene 73	169
25.	Rosario 1	Set 71	167
26.	Mexico 12	Dic 72	158
27.	Mexico 4	Dic 72	154
28.	Mexico 7	Ene 69	151
29.	Buenos Aires 23	Jun 72	150
30.	São Paulo 7	Jul 73	150
31.	Buenos Aires 3	Ago 69	144
32.	São Paulo 2	Jun 73	142
33.	Montevideo 1	Ago 69	135
34.	Mexico 5	Dic 74	125
35.	Mexico 9	Ene 73	125
36.	Bogota 1	Ene 69	123
37.	Mexico 13	Ene 73	122
38.	São Paulo 10	Set 73	120
39.	Caracas 1	May 72	118
40.	Buenos Aires 22	Jul 71	116
41.	Medellin 2	Abr 74	115
42.	São Paulo 4	Jun 73	104
43.	San Jose 1	Dic 73	102
44.	Bogota 3	Ago 74	102
			----- R.L.
45.	São Paulo 6	Set 73	98
46.	Medellin 3	Nov 73	90
47.	São Paulo 3	Jun 73	89
48.	Curitiba 1	Jul 74	84
49.	São Paulo 5	Jul 73	80
50.	Medellin 4	Mar 73	76
51.	Mendoza 1	Jul 71	74
52.	São Paulo 9	Set 73	72
53.	La Paz 1	Jun 73	70
54.	Guatemala 1	May 74	66
55.	La Habana 3	Ene 74	65
56.	Bogota 4	Feb 72	65
57.	São Paulo 11	Set 73	63
58.	La Habana 5	Nov 73	62
59.	Medellin 1	Set 73	62
60.	Bogota 2	Oct 73	58
61.	Cali 1	Set 72	58
62.	Kingston 1	Set 69	54
63.	Porto Alegre 1	Jun 73	52
64.	Barranquilla 2	Feb 74	51
65.	Lima 1	Ago 67	48
66.	Bogota 5	Nov 73	47
67.	Bucaramanga 1	Dic 72	47
68.	Mendoza 2	Jul 73	46
69.	Cali 2	Oct 71	44
70.	Caracas 7	Abr 73	43
71.	Cali 3	Set 74	41
72.	Caracas 4	Dic 71	41
73.	Barranquilla 3	Ago 73	42
			----- L.T.G.
74.	Caracas 8	Dic 74	38
75.	Caracas 5	Mar 73	35
76.	Caracas 3	Set 73	34
77.	Lima 3	Ago 72	33
78.	Caracas 6	Nov 72	32
79.	Caracas 2	Oct 73	31
80.	Lima 4	May 73	29
81.	La Habana 11	Oct 74	27
82.	São Paulo 8	Set 73	26
83.	Lima 2	Feb 74	25
84.	Maracaibo 1	Mar 74	24
85.	Santiago de Cuba 1	Jun 74	24
86.	Bogota 6	Mar 72	23
87.	Cartagena 1	Ago 73	23
88.	Cali 4	Set 74	23
89.	Holguin 1	Oct 74	22
90.	Barranquilla 1	Oct 74	14
91.	Maracaibo 2	Mar 74	14
92.	Santiago de Cuba 2	Nov 74	9

(47.8%) have maximum values over the one suggested as a basis of comparison, but 73 (79.3%) are over the L.T.G. Twenty-eight stations (30.4%), on the other hand, had all their monthly averages below one half the Reference Level, situation that authorities should try to maintain.

In Table 11 the stations are presented in decreasing order of the maximum daily value observed at each one, showing again the month when this maximum value occurred. Figures are now much higher, a situation masked partially by calculating averages. The maximum value obtained in the whole Network was 978 $\mu g/m^3$, reported by Mexico 3 for January 1971. All fourteen stations in Mexico City are among the highest 29 values observed, and at all of them the maximum value was practically equal or much higher than four times the Reference Level. Similar figures are also found at some stations in Havana, Sao Paulo, Buenos Aires, Mendoza, Bogota, Santiago, San Salvador, Rio de Janeiro and Cordoba. A total of 75 stations (81.5%) collected values equal to or above the Reference Level, at some time during their period of operation, and only 17 stations (18.5%) had all their results below 100 $\mu g/m^3$. If a comparison is made with the value recommended by WHO as the Long-Term Goal, 40 $\mu g/m^3$, only one station (1.1%), Santiago de Cuba 2, which has collected samples during only two months, would have all its results below this figure.

In Table 12 results are analyzed by calculating the percentage of total samples exceeding the Reference Level. Upon arranging the stations in decreasing order of this percentage, San Salvador 2 and Mendoza 9 appear in first place, both with more than 99% of all the daily samples above the REDPANAIRE Reference Level. Most of the stations in Mexico City, Buenos Aires, Sao Paulo and Santiago show very high percentages of samples exceeding the basis of comparison. At 33 stations (35.9%) 1% or less of the results are above the Reference Level. Of these, 18 (19.6%) show satisfactory results in 100% of the cases. This situation will change substantially if compared with the WHO Long-Term Goal.

In Table 13 all samples collected in each of the 28 cities which submitted results for suspended dust during the period included in this report have been grouped. In seven of them (25%) - San Salvador, Rosario, Buenos Aires, Montevideo, Sao Paulo, Havana and Mexico City - over one third of all samples exceeds the Reference Level. In only 10 cities (35.7%) this excess is found in less than 1% of the samples. In five of them (17.9%) - Lima, Bucaramanga, Santiago de Cuba, Holguin and Maracaibo - all samples were below the Reference Level.

As mentioned previously, these average values can be considered statistically significant when they include analysis of a large number of samples, as is the case with Mexico City where, during the period in question, a total of 21 853 samples from 14 stations have been collected. Figures for cities like Curitiba, Rosario, Cartagena, Holguin and Maracaibo, with only a relatively small number of results, should be considered strictly as preliminary estimates.

Table 11

REDPANAIRE - SUSPENDED DUST (1967 - 1974)

Network stations in decreasing order of the maximum daily value obtained in each station, with indication of the month when this maximum value occurred ($\mu g/m^3$)

	Station	Month	Maximum daily value	
1.	Mexico 3	Ene 71	978	
2.	Mexico 1	Ene 73	957	
3.	La Habana 2	Nov 74	931	
4.	Mexico 6	Dic 72	888	
5.	São Paulo 1	Jun 72	877	
6.	Buenos Aires 1	Jun 72	860	
7.	La Habana 6	Oct 73	838	
8.	Mexico 11	Ene 73	834	
9.	Buenos Aires 3	Ago 69	814	
10.	Mexico 4	Ene 73	791	
11.	Mexico 10	Ene 73	780	
12.	Mexico 7	Ene 71	755	
13.	Mexico 14	Ene 73	735	
14.	Mexico 9	Dic 72	734	
15.	La Habana 1	Set 73	646	
16.	Mendoza 9	Oct 73	621	
17.	Mexico 8	Ene 73	600	
18.	Mexico 2	Dic 74	598	
19.	Mexico 13	Dic 72	573	
20.	Buenos Aires 2	Feb 68	552	
21.	Buenos Aires 4	Jun 70	489	
22.	Bogota 3	Set 74	469	
23.	Santiago 1	Jul 73	466	
24.	San Salvador 2	Ago 73	457	
25.	Rio de Janeiro 1	Ene 69	436	
26.	Cordoba 1	Jun 69	405	
27.	Buenos Aires 23	Ago 72	400	
28.	Mexico 12	Dic 73	396	
29.	Mexico 5	Set 74	395	
30.	San Salvador 1	Mar 72	376	
31.	Santiago 2	Ago 67	375	
32.	La Habana 3	Ene 74	373	
33.	Montevideo 2	Jun 74	354	
34.	Bogota 4	Feb 72	347	
35.	Porto Alegre 1	Ago 73	335	
36.	Buenos Aires 22	Jul 71	320	
37.	Cordoba 2	May 71	320	
38.	São Paulo 7	Jun 73	309	
39.	La Habana 5	Nov 73	305	
40.	São Paulo 2	Jun 73	301	
41.	São Paulo 4	Jun 73	295	
42.	Montevideo 1	Jul 70	287	
43.	Medellin 3	May 74	284	
44.	San Jose 1	Dic 73	269	
45.	Barranquilla 2	Set 73	252	
46.	Medellin 2	Set 74	252	
47.	Rosario 1	Oct 71	250	
48.	São Paulo 5	Jul 73	243	
49.	São Paulo 3	Jun 73	236	
50.	Guatemala 1	May 74	236	
51.	Curitiba 1	Jul 74	228	
52.	La Habana 11	Nov 74	224	
53.	São Paulo 6	Jun 73	219	
54.	Bogota 1	Nov 68	212	
55.	São Paulo 10	Ago 73	187	
56.	São Paulo 11	Ago 73	186	
57.	Caracas 1	Dic 71	186	
58.	Bogota 2	Dic 73	185	
59.	Caracas 8	Set 72	185	
60.	Medellin 1	Ago 74	180	
61.	São Paulo 9	Ago 73	166	
62.	La Paz 1	Jun 73	157	
63.	Cartagena 1	Ago 73	142	
64.	Mendoza 1	Jul 71	136	
65.	Caracas 6	Ene 73	132	
66.	Medellin 4	Dic 74	125	
67.	Kingston 1	Feb 69	124	
68.	Bogota 5	Ago 74	120	
69.	Cali 1	Oct 74	118	
70.	Barranquilla 3	Nov 73	115	
71.	São Paulo 8	Ago 73	114	
72.	Caracas 4	Mar 73	111	
73.	Mendoza 2	Jun 72	110	
74.	Cali 2	Ago 74	100	
75.	Lima 3	Feb 73	100	—— R.L.
76.	Bucaramanga 1	Dic 72	95	
77.	Caracas 3	Oct 71	92	
78.	Lima 1	Feb 74	90	
79.	Cali 3	Set 71	89	
80.	Caracas 7	Mar 73	82	
81.	Caracas 2	Oct 74	77	
82.	Holguin 1	Oct 74	75	
83.	Lima 4	Dic 73	70	
84.	Bogota 6	Abr 73	69	
85.	Caracas 5	Mar 73	69	
86.	Santiago de Cuba 1	Ago 74	59	
87.	Lima 2	Feb 74	55	
88.	Cali 4	Jun 74	54	
89.	Maracaibo 2	Mar 74	51	
90.	Barranquilla 1	Feb 74	41	
91.	Maracaibo 1	Mar 74	41	----- L. T. G.
92.	Santiago de Cuba 2	Dic 74	35	

Table 12

REDPANAIRE - SUSPENDED DUST (1967 - 1974)

Network stations in decreasing order of the percentage of total samples exceeding the proposed Reference Level of 100 μg/m³

	Station	No. of daily samples	> 100 N°	> 100 %
1.	San Salvador 2	342	340	99.4
2.	Mendoza 9	242	240	99.2
3.	Montevideo 2	454	399	87.9
4.	Buenos Aires 2	456	344	75.4
5.	Mexico 6	1845	1376	74.6
6.	Buenos Aires 1	1772	1278	72.1
7.	São Paulo 1	1749	1206	69.0
8.	La Habana 2	1275	821	64.4
9.	Mexico 3	2202	1354	61.5
10.	Rosario 1	186	112	60.2
11.	La Habana 1	1707	962	56.4
12.	São Paulo 7	238	133	55.9
13.	San Salvador 1	1011	489	48.4
14.	São Paulo 2	353	168	47.6
15.	Mexico 1	2326	1056	45.4
16.	Buenos Aires 4	202	89	44.1
17.	Mexico 2	2137	823	38.5
18.	Mexico 10	1365	495	36.3
19.	Mexico 11	1083	390	36.0
20.	Mexico 12	437	154	35.2
21.	São Paulo 10	171	60	35.1
22.	Mexico 8	1780	557	31.3
23.	Mexico 7	1821	556	30.5
24.	Santiago 1	2310	677	29.3
25.	Santiago 2	845	243	28.8
26.	Montevideo 1	997	280	28.1
27.	Rio de Janeiro 1	1326	364	27.5
28.	Mexico 14	466	125	26.8
29.	Buenos Aires 23	660	147	22.3
30.	Mexico 4	2192	463	21.1
31.	São Paulo 4	252	53	21.0
32.	São Paulo 6	169	33	19.5
33.	Buenos Aires 22	228	41	18.0
34.	Medellin 2	885	149	16.8
35.	Bogota 3	195	31	15.9
36.	Caracas 1	1718	260	15.1
37.	Curitiba 1	142	21	14.8
38.	São Paulo 5	257	35	13.6
39.	Cordoba 1	951	126	13.3
40.	Cordoba 2	675	81	12.0
41.	Mexico 13	469	56	11.9
42.	Mexico 5	2138	230	10.8
43.	Medellin 3	948	94	9.9
44.	Buenos Aires 3	258	25	9.7
45.	Mexico 9	1592	148	9.3
46.	São Paulo 3	325	29	8.9
47.	São Paulo 11	175	14	8.0
48.	Bogota 1	2310	176	7.6
49.	Guatemala 1	520	38	7.3
50.	São Paulo 9	172	12	7.0
51.	La Habana 5	409	26	6.4
52.	La Habana 6	434	14	3.2
53.	San Jose 1	835	24	2.9
54.	La Habana 3	414	11	2.7
55.	La Habana 11	175	4	2.3
56.	Medellin 1	975	15	1.5
57.	Porto Alegre 1	1549	17	1.1
58.	Bogota 4	946	10	1.1
59.	Medellin 4	851	9	1.1
60.	Barranquilla 2	770	8	1.0
61.	Mendoza 1	199	2	1.0
62.	São Paulo 8	179	1	0.6
63.	Bogota 5	932	5	0.5
64.	La Paz 1	857	3	0.4
65.	Bogota 2	777	3	0.4
66.	Mendoza 2	530	2	0.4
67.	Kingston 1	471	2	0.4
68.	Cartagena 1	230	1	0.4
69.	Cali 2	323	1	0.3
70.	Cali 1	298	1	0.3
71.	Caracas 4	1249	3	0.2
72.	Barranquilla 3	534	1	0.2
73.	Caracas 8	438	1	0.2
74.	Caracas 6	696	1	0.1
75.	Lima 1	1968	0	0.0
76.	Caracas 3	1714	0	0.0
77.	Caracas 2	1683	0	0.0
78.	Bucaramanga 1	903	0	0.0
79.	Caracas 5	896	0	0.0
80.	Bogota 6	867	0	0.0
81.	Lima 2	853	0	0.0
82.	Lima 4	822	0	0.0
83.	Lima 3	779	0	0.0
84.	Barranquilla 1	602	0	0.0
85.	Caracas 7	571	0	0.0
86.	Santiago de Cuba 1	325	0	0.0
87.	Cali 3	300	0	0.0
88.	Holguin 1	231	0	0.0
89.	Cali 4	173	0	0.0
90.	Maracaibo 1	110	0	0.0
91.	Maracaibo 2	108	0	0.0
92.	Santiago de Cuba 2	38	0	0.0
		76 343	17 518	22.9

Table 13

REDPANAIRE - SUSPENDED DUST (1967 - 1974)

Cities included in the Network in decreasing order of the percentage of all daily samples exceeding the proposed Reference Level of 100 μg/m³

City	Stations in city	Total daily samples	Samples exceeding 100 μg/m³	%
1. San Salvador	2	1 353	829	61.3
2. Rosario	1	186	112	60.2
3. Buenos Aires	6	3 576	1 924	53.8
4. Montevideo	2	1 451	679	46.8
5. São Paulo	11	4 040	1 744	43.2
6. Havana	6	4 414	1 838	41.6
7. Mexico City	14	21 853	7 783	35.6
8. Santiago	2	3 155	920	29.2
9. Rio de Janeiro	1	1 326	364	27.5
10. Mendoza	3	971	244	25.1
11. Curitiba	1	142	21	14.8
12. Cordoba	2	1 626	207	12.7
13. Guatemala	1	520	38	7.3
14. Medellin	4	3 659	267	7.3
15. Bogota	6	6 027	225	3.7
16. Caracas	8	8 965	265	3.0
17. San Jose	1	835	24	2.9
18. Porto Alegre	1	1 549	17	1.1
19. Barranquilla	3	1 906	9	0.5
20. Cartagena	1	230	1	0.4
21. Kingston	1	471	2	0.4
22. La Paz	1	857	3	0.4
23. Cali	4	1 094	2	0.2
24. Lima	4	4 422	0	0.0
25. Bucaramanga	1	903	0	0.0
26. Santiago de Cuba	2	363	0	0.0
27. Holguin	1	231	0	0.0
28. Maracaibo	2	218	0	0.0
	92	76 343	17 518	22.9

11. SULFUR DIOXIDE

The analysis of the findings of the 93 REDPANAIRE stations that submitted results for this pollutant during the period included in this report starts with Table 14, in which they are presented in decreasing order of the general arithmetic mean of the monthly averages of the measured concentrations. Twenty-four stations (25%) reached general averages over 70 $\mu g/m^3$, value proposed as the Reference Level. If the comparison is made with the WHO Long-Term Goal, 60 $\mu g/m^3$, three additional stations will be above this figure, increasing the total to 27 (29.0%). Of these, nine operate in Sao Paulo and 12 in Mexico City. Of the remaining six, two are located in Santiago and one each in Montevideo, Havana, Caracas, and Cordoba. Only two stations of a total of 11 in Sao Paulo, and two out of 14 in Mexico City, show general averages below these figures. The highest value is found in Sao Paulo and the second highest in Mexico City. Of seven stations with over twice the WHO Long-Term Goal, two are located in Sao Paulo and five in Mexico City. This seems to justify the priority that the respective authorities are giving to the development of preventive and control programs.

In Table 15 stations are grouped in decreasing order of the highest monthly average obtained at each station. This average was higher than the Reference Level for at least one month at 39 stations (41.9%). This figure reaches 43 (46.2%) if the WHO Long-Term Goal is used. The highest monthly average was found at Sao Paulo 11 and occurred in October 1973. The next four were reported by stations in Mexico City. On the other hand, at 36 stations (38.7%) all the monthly averages were less than one half the Reference Level, situation that should be considered satisfactory, although in some cases measurements have been made during very short periods, and therefore the results should be considered as only preliminary.

The maximum daily values obtained are very high. As can be seen in Table 16, at 59 stations (63.4%) concentrations equal to or above the Reference Level were found. This number increases to 66 (71%) if comparison is made with the WHO Long-Term Goal. The highest concentration in the whole Network occurred at Mexico 1 in June 1973 with 962 $\mu g/m^3$, almost 14 times the Reference Level. At 42 stations (45.2%) maximum values over twice the basis of comparison were found, and at 26 of these (28%) the maximum daily value was equal to or higher than five times the Reference Level. At the other end of the table, only 16 stations (17.2%) show all their daily concentrations below one half of the Reference Level. At a total of 34 stations (36.6%) all figures obtained were below the Reference Level, situation that should be considered satisfactory. If the comparison is made with the WHO Long-Term Goal, the number of stations in these conditions is reduced to 27 (29.0%).

In Table 17 the Network stations are arranged in decreasing order of the percentage of total samples exceeding 70 $\mu g/m^3$, the basis of comparison. At 19 stations (20.4%) over 50% of all analyses gave results higher than the Reference Level. Of these, seven are located in Mexico City, nine in Sao Paulo, and the other three in Caracas, Montevideo, and Havana. Forty-four stations (47.3%) have less than 1% of the total measurements below the Reference Level.

Table 14

REDPANAIRE - SULFUR DIOXIDE (1967 - 1974)

Network stations in decreasing order of the arithmetic mean of monthly average concentrations (μg/m³)

	Station	General mean	No. of monthly averages
1.	São Paulo 11	246.3	10
2.	Mexico 10	142.3	51
3.	Mexico 3	137.8	78
4.	Mexico 11	136.7	39
5.	Mexico 12	135.0	16
6.	Mexico 1	134.1	80
7.	São Paulo 7	130.0	10
8.	São Paulo 2	108.8	12
9.	Montevideo 2	107.9	13
10.	São Paulo 10	104.2	10
11.	São Paulo 6	103.3	10
12.	Mexico 6	96.9	65
13.	La Habana 1	90.8	58
14.	Mexico 9	90.7	56
15.	São Paulo 1	86.0	67
16.	Caracas 3	80.5	67
17.	São Paulo 4	79.7	11
18.	São Paulo 9	77.7	10
19.	Santiago 1	77.6	82
20.	Mexico 8	76.3	62
21.	Mexico 7	74.7	64
22.	Mexico 5	73.3	75
23.	Mexico 13	73.2	17
24.	Cordoba 2	72.0	24
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25.	Santiago 2	69.0	31
26.	São Paulo 5	60.6	11
27.	Mexico 2	60.1	75
		------- L.T.G.	
28.	Mexico 4	58.0	77
29.	Rosario 1	50.3	5
30.	Mexico 14	50.1	17
31.	Bogota 3	49.7	7
32.	Río de Janeiro 1	49.6	86
33.	Buenos Aires 23	49.0	24
34.	Buenos Aires 1	42.3	71
35.	Porto Alegre 1	40.7	52
36.	Montevideo 1	39.2	36
37.	Medellin 3	38.2	38
38.	La Habana 2	36.2	48
39.	Medellin 2	34.6	35
40.	Bogota 1	29.5	81
41.	La Habana 6	29.4	19
42.	Medellin 4	28.7	34
43.	Belo Horizonte 1	28.1	29
44.	Medellin 1	26.6	37
45.	Bogota 4	26.6	32
46.	Buenos Aires 2	26.6	18
47.	Bogota 2	25.2	28
48.	La Habana 3	24.7	19
49.	Bogota 5	23.0	32
50.	Cali 1	20.2	23
51.	San Salvador 2	19.8	18
52.	Buenos Aires 3	19.7	10
53.	San Jose 1	15.9	34
54.	Caracas 2	15.2	62
55.	Caracas 4	15.2	47
56.	La Habana 5	15.0	18
57.	Cordoba 1	14.7	40
58.	Mendoza 2	14.3	37
59.	Cartagena 1	13.9	4
60.	Caracas 1	13.6	64
61.	Buenos Aires 22	12.0	8
62.	San Salvador 1	11.6	46
63.	Caracas 6	11.3	27
64.	Cali 3	11.3	23
65.	La Habana 11	11.3	7
66.	São Paulo 8	11.2	10
67.	Buenos Aires 4	11.2	8
68.	São Paulo 3	10.9	11
69.	Kingston 1	10.4	22
70.	Caracas 5	10.3	38
71.	Caracas 7	10.0	22
72.	Guatemala 1	9.0	17
73.	Caracas 8	8.9	16
74.	Holguin 1	8.6	9
75.	Lima 1	7.5	66
76.	Bogota 6	7.5	30
77.	Curitiba 1	7.0	5
78.	Maracaibo 2	6.2	5
79.	Lima 2	6.1	34
80.	Mendoza 9	5.0	12
81.	Lima 3	4.9	34
82.	Cali 2	4.7	24
83.	Bucaramanga 1	4.3	40
84.	Barranquilla 2	4.1	25
85.	Cali 4	4.1	13
86.	Maracaibo 1	3.7	5
87.	Mendoza 1	2.8	2
88.	Lima 4	2.6	19
89.	Santiago de Cuba 2	2.2	2
90.	Barranquilla 1	1.7	22
91.	Santiago de Cuba 1	1.1	11
92.	La Paz 1	1.0	29
93.	Barranquilla 3	0.7	13

Table 15

REDPANAIRE - SULFUR DIOXIDE (1967 - 1974)

Network stations in decreasing order of the maximum monthly average obtained at each station, with indication of the month this maximum average occurred (ug/m^3)

	Station	Month	Maximum monthly average
1.	São Paulo 11	Oct 73	359
2.	Mexico 10	Set 71	289
3.	Mexico 11	Nov 74	244
4.	Mexico 3	Dic 70	242
5.	Mexico 1	May 71	237
6.	Santiago 1	Jun 67	233
7.	Cordoba 2	Ene 73	230
8.	São Paulo 1	Jun 72	223
9.	Caracas 3	May 70	207
10.	La Habana 1	Abr 74	179
11.	São Paulo 7	Jun 73	178
12.	Mexico 6	May 71	174
13.	Santiago 2	Jul 67	173
14.	Mexico 12	Jun 73	169
15.	Montevideo 2	Ene 74	158
16.	São Paulo 3	Jun 73	156
17.	Mexico 8	Feb 72	155
18.	São Paulo 2	Jul 73	154
19.	Mexico 9	Ene 72	144
20.	Mexico 5	May 71	138
21.	Buenos Aires 1	Oct 71	134
22.	São Paulo 10	Oct 73	132
23.	São Paulo 6	Set 73	130
24.	Rio de Janeiro 1	Jun 72	127
25.	Mexico 7	May 71	124
26.	Mexico 2	Nov 71	115
27.	Mexico 4	Abr 71	111
28.	La Habana 2	Abr 73	104
29.	Rosario 1	Dic 71	103
30.	Mexico 13	May 74	103
31.	Montevideo 1	Jul 70	102
32.	São Paulo 4	Ago 73	98
33.	São Paulo 9	Set 73	94
34.	Barranquilla 2	Jul 73	90
35.	La Habana 6	Oct 73	86
36.	Mexico 14	May 74	83
37.	Buenos Aires 23	Oct 73	79
38.	Porto Alegre 1	Abr 71	77
39.	São Paulo 5	Jun 73	75
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40.	Buenos Aires 2	Jul 68	69
41.	Bogota 1	Nov 67	65
42.	Bogota 4	Feb 72	65
43.	Bogota 3	Ago 74	63
			------ L.T.G.
44.	Belo Horizonte 1	Ago 73	57
45.	San Jose 1	Oct 73	56
46.	Medellin 4	Dic 71	52
47.	Bogota 2	Jun 73	47
48.	Cordoba 1	Oct 74	47
49.	Medellin 3	Jun 74	47
50.	Medellin 2	Ene 72	45
51.	Bogota 5	Feb 72	45
52.	La Habana 3	Dic 73	43
53.	Medellin 1	Ene 72	42
54.	La Habana 5	Dic 73	41
55.	Cali 1	Oct 71	41
56.	Caracas 4	Jun 71	39
57.	Caracas 6	Ago 72	35
58.	Caracas 2	May 70	34
59.	Mendoza 2	Nov 71	33
60.	Lima 1	Mar 71	31
61.	Buenos Aires 3	Set 69	30
62.	San Salvador 2	Dic 74	29
63.	Caracas 1	Jun 68	24
64.	Buenos Aires 4	Feb 71	23
65.	Buenos Aires 22	Nov 71	23
66.	Caracas 8	Set 72	22
67.	Cali 2	Nov 72	22
68.	Guatemala 1	Mar 73	21
69.	Cartagena 1	Oct 73	21
70.	Kingston 1	Ene 68	21
71.	San Salvador 1	Feb 73	19
72.	Caracas 5	Set 72	19
73.	Cali 3	Oct 72	18
74.	Lima 2	Abr 74	18
75.	Mendoza 9	Ene 73	18
76.	Bogota 6	Feb 73	17
77.	Caracas 7	Abr 73	16
78.	La Habana 11	Dic 74	16
79.	São Paulo 8	Jun 73	16
80.	Bucaramanga 1	Ago 74	13
81.	Holguin 1	Dic 74	12
82.	Lima 3	Abr 73	11
83.	Curitiba 1	Jul 74	11
84.	Cali 4	Set 72	10
85.	Maracaibo 2	Nov 73	8
86.	Lima 4	Feb 72	8
87.	Maracaibo 1	Feb 74	7
88.	Barranquilla 1	Ene 72	5
89.	Mendoza 1	Oct 70	4
90.	Santiago de Cuba 1	Mar 74	4
91.	Santiago de Cuba 2	Dic 74	3
92.	Barranquilla 3	Ene 73	3
93.	La Paz 1	Set 73	2

Table 16

REDPANAIRE - SULFUR DIOXIDE (1967 - 1974)

Network stations in decreasing order of the maximum daily value obtained at each station, with indication of the month this maximum value occurred ($\mu g/m^3$)

	Station	Month	Maximum daily value	
1.	Mexico 1	Jun 73	962	
2.	Mexico 10	Ene 71	859	
3.	Mexico 3	Nov 69	828	
4.	São Paulo 11	Nov 73	822	
5.	Mexico 8	May 73	712	
6.	Mexico 12	Jul 72	673	
7.	Mexico 11	Abr 73	626	
8.	La Habana 1	May 73	611	
9.	Montevideo 2	May 74	579	
10.	La Habana 2	Nov 74	561	
11.	Mexico 6	Nov 72	521	
12.	Caracas 3	Ago 70	507	
13.	Santiago 1	Ago 68	472	
14.	São Paulo 1	Jun 72	472	
15.	Mexico 5	Oct 71	467	
16.	Buenos Aires 1	Nov 72	460	
17.	Montevideo 1	Ago 69	449	
18.	São Paulo 3	Set 73	437	
19.	Mexico 9	Ene 71	406	
20.	Cordoba 2	Ene 73	399	
21.	Mexico 2	Jul 71	383	
22.	Porto Alegre 1	Nov 71	370	
23.	São Paulo 2	Jun 73	368	
24.	Mexico 13	Feb 73	358	
25.	La Habana 6	Ago 73	354	
26.	Mexico 7	May 74	350	
27.	São Paulo 7	Ago 73	339	
28.	Santiago 2	Ago 67	329	
29.	Mexico 14	May 74	308	
30.	Mexico 4	Abr 71	302	
31.	São Paulo 10	Oct 73	291	
32.	La Habana 3	Dic 73	290	
33.	Barranquilla 2	Jul 73	271	
34.	São Paulo 6	Ago 73	245	
35.	Rosario 1	Dic 71	225	
36.	Rio de Janeiro 1	Ago 72	224	
37.	La Habana 5	Dic 73	223	
38.	São Paulo 4	Ago 73	217	
39.	Buenos Aires 23	Oct 73	184	
40.	São Paulo 9	Dic 73	175	
41.	São Paulo 5	Ago 73	166	
42.	Medellin 3	May 72	154	
43.	Belo Horizonte 1	Ago 73	131	
44.	San Jose 1	Oct 73	128	
45.	Medellin 1	Ene 72	126	
46.	Medellin 4	Dic 71	123	
47.	Cali 2	Nov 72	118	
48.	Bogota 3	Set 74	111	
49.	Buenos Aires 2	Jul 68	111	
50.	Cali 1	Oct 72	110	
51.	Medellin 2	May 72	104	
52.	La Habana 11	Dic 74	102	
53.	Cordoba 1	Nov 69	100	
54.	Bogota 4	Feb 72	100	
55.	Bogota 5	Jul 73	99	
56.	San Salvador 1	Ago 72	91	
57.	Bogota 1	Dic 67	84	
58.	Buenos Aires 3	Abr 70	80	
59.	Caracas 2	Jul 71	70	--- R.L.
60.	Caracas 4	Jul 71	67	
61.	Cali 3	Set 72	66	
62.	Bogota 2	Dic 73	63	
63.	Caracas 6	Set 72	62	
64.	Lima 1	Dic 67	62	
65.	Mendoza 2	Nov 71	61	
66.	Bogota 6	Abr 73	60	--- L.T.G.
67.	Guatemala 1	Abr 73	58	
68.	Caracas 1	Jun 73	55	
69.	Kingston 1	Ene 68	54	
70.	Cartagena 1	Oct 73	51	
71.	Buenos Aires 4	Jun 70	50	
72.	Caracas 8	Set 73	49	
73.	Buenos Aires 22	Abr 71	46	
74.	Mendoza 9	Ago 73	43	
75.	Cali 4	Jul 74	42	
76.	San Salvador 2	Nov 74	42	
77.	Caracas 5	Nov 71	37	
78.	Lima 2	Abr 74	34	
79.	São Paulo 8	Jul 73	34	
80.	Caracas 7	Abr 73	31	
81.	Bucaramanga 1	May 74	28	
82.	Curitiba 1	Jul 73	26	
83.	Barranquilla 1	Ene 72	25	
84.	Lima 3	Feb 72	25	
85.	Lima 4	Ene 72	23	
86.	Holguin 1	Dic 74	23	
87.	Santiago de Cuba 1	Mar 74	23	
88.	Mendoza 1	Oct 70	15	
89.	Maracaibo 1	Nov 73	12	
90.	Maracaibo 2	Dic 73	13	
91.	Santiago de Cuba 2	Dic 74	10	
92.	Barranquilla 3	Ene 74	9	
93.	La Paz 1	Set 73	6	

Table 17

REDPANAIRE - SULFUR DIOXIDE (1967 - 1974)

Network stations in decreasing order of the percentage of daily samples exceeding the proposed Reference Level of 70 µg/m³

	Station	No. of daily samples	> 70 N°	> 70 %		Station	No. of daily samples	> 70 N°	> 70 %
1.	Mexico 12	434	396	91.2	48.	Medellin 4	864	10	1.2
2.	Mexico 3	2198	1950	88.7	49.	Bogota 4	928	10	1.1
3.	Mexico 11	1084	952	87.8	50.	Bogota 5	910	7	0.8
4.	São Paulo 11	160	140	87.5	51.	Barranquilla 2	145	1	0.7
5.	São Paulo 7	238	205	86.1	52.	La Habana 11	177	1	0.6
6.	Mexico 10	1388	1187	85.5	53.	Medellin 1	1000	5	0.5
7.	Mexico 1	2346	1921	81.9	54.	Bogota 1	2308	11	0.5
8.	São Paulo 6	171	140	81.9	55.	Cali 2	228	1	0.4
9.	São Paulo 3	325	255	78.5	56.	Buenos Aires 3	250	1	0.4
10.	São Paulo 10	169	131	77.5	57.	Cordoba 1	866	2	0.2
11.	São Paulo 2	353	260	73.7	58.	Caracas 2	1615	1	0.1
12.	Mexico 6	1849	1262	68.3	59.	Caracas 1	1674	0	0.0
13.	Mexico 9	1609	996	61.9	60.	Lima 1	1569	0	0.0
14.	São Paulo 4	241	146	60.6	61.	Caracas 4	1199	0	0.0
15.	São Paulo 9	173	99	57.2	62.	San Salvador 1	999	0	0.0
16.	São Paulo 1	1875	1071	57.1	63.	Bucaramanga 1	870	0	0.0
17.	Caracas 3	1757	984	56.0	64.	Caracas 5	864	0	0.0
18.	Montevideo 2	293	163	55.6	65.	Bogota 6	853	0	0.0
19.	La Habana 1	1716	926	54.0	66.	La Paz 1	846	0	0.0
20.	Mexico 7	1815	874	48.2	67.	Bogota 2	745	0	0.0
21.	Mexico 8	1781	840	47.2	68.	Lima 2	703	0	0.0
22.	Santiago 1	2269	1053	46.4	69.	Caracas 6	695	0	0.0
23.	Mexico 5	2127	973	45.7	70.	Lima 3	656	0	0.0
24.	Mexico 3	462	197	42.6	71.	Caracas 7	567	0	0.0
25.	Santiago 2	848	318	37.5	72.	Mendoza 2	524	0	0.0
26.	Cordoba 2	660	232	35.2	73.	Guatemala 1	477	0	0.0
27.	São Paulo 5	257	86	33.5	74.	Barranquilla 1	325	0	0.0
28.	Mexico 2	2065	657	31.8	75.	San Salvador 2	324	0	0.0
29.	Rosario 1	98	30	30.6	76.	Caracas 8	298	0	0.0
30.	Mexico 4	2170	622	28.7	77.	Cali 3	288	0	0.0
31.	Rio de Janeiro 1	1348	276	20.5	78.	Santiago de Cuba 1	261	0	0.0
32.	Buenos Aires 1	1783	300	16.8	79.	Kingston 1	250	0	0.0
33.	Buenos Aires 23	652	107	16.4	80.	Holguin 1	231	0	0.0
34.	Bogota 3	195	30	15.4	81.	Buenos Aires 22	226	0	0.0
35.	Mexico 14	449	64	14.3	82.	Mendoza 9	170	0	0.0
36.	La Habana 2	1274	161	12.6	83.	São Paulo 8	169	0	0.0
37.	Montevideo 1	918	114	12.4	84.	Lima 4	168	0	0.0
38.	Porto Alegre 1	1546	157	10.2	85.	Cali 4	142	0	0.0
39.	La Habana 6	435	35	8.0	86.	Buenos Aires 4	140	0	0.0
40.	Buenos Aires 2	446	27	6.1	87.	Curitiba 1	137	0	0.0
41.	La Habana 3	415	15	3.6	88.	Maracaibo 2	104	0	0.0
42.	Medellin 2	911	22	2.4	89.	Barranquilla 3	80	0	0.0
43.	Cali 1	282	6	2.1	90.	Maracaibo 1	70	0	0.0
44.	La Habana 5	390	8	2.1	91.	Mendoza 1	22	0	0.0
45.	Belo Horizonte 1	749	15	2.0	92.	Cartagena 1	21	0	0.0
46.	San Jose 1	953	18	1.9	93.	Santiago de Cuba 2	20	0	0.0
47.	Medellin 3	970	14	1.4			72 625	20 485	28.2

Table 18 very clearly divides the cities into two groups, according to the total samples analyzed for each of them which exceed the figure proposed as the Reference Level. Of the 29 cities that submitted results during the period included in this report, 11 (37.9%) have over 10% of their results above the Reference Level, while in the other 18 (62.1%) this value was exceeded in only 2% or less of the cases. In 12 cities (41.4%) all figures were below the basis of comparison, presenting an acceptable situation, especially when it is the result of a large number of measurements, as is the case with Lima, San Salvador, Bucaramanga, La Paz and Mendoza. The highest values were found in Sao Paulo and Mexico City, with 61.3% and 59.2% of all samples above the Reference Level. Santiago, Rosario and Havana follow in decreasing order. It should be kept in mind, however, that there are only 98 samples for Rosario, too few for a clear definition of the situation in that city. The case is very different for Mexico City, where 21 777 analyses were made during this period, of which 12 891 exceeded the Reference Level.

12. GENERAL SITUATION IN EACH CITY

It is extremely difficult to establish a general comparison among the different cities since there are no appropriate criteria to assign a weighting factor to the relative toxicity, or what could be called the "damage potential" of each one of the three pollutants measured by REDPANAIRE. In an attempt at a comparison, of controversial validity, in Table 19 cities are presented in decreasing order of the percentage of all samples taken in each one of them exceeding the values proposed as Reference Levels. It should be stressed that this general comparison should be regarded only as an approximation since the specific characteristics of each city are very variable, as are the number of stations and the length of the sampling period, data also included in the same table. However, when figures come from several stations and include 24 or more months of sampling, they can be considered as reasonably significant.

In five cities (17.2%) of the 29 included in this report, 1% or less of the samples exceeded the Reference Levels, a situation that can be considered as acceptable. In the other 24 (82.8%) over 1% of the samples, a figure that in three of them approaches or exceeds 50%, were above these levels. In eleven cities (37.9%) the percentage of samples in excess is 15% or more, while in the other 18 it is lower than 10%. Although the situation can be considered serious in only two cities, these percentages reveal potentially dangerous conditions which, as they are worsened by demographic and industrial growth, will soon result in significant damages to the health and economy of urban inhabitants unless needed prevention and control measures are applied in time.

A short discussion of the situation in each city will follow.

12.1 Sao Paulo

Sao Paulo is in first place in Table 19, with 52.7% of all samples above the Reference Levels. Eleven stations are operating in the city and

Table 18

REDPANAIRE - SULFUR DIOXIDE (1967-1974)

Cities included in the Network in decreasing order of the percentage of all daily samples exceeding the proposed Reference Level of 70 μg/m^3

City	Stations in city	Total daily samples	Samples exceeding 70 μg/m^3	%
1. São Paulo	11	4 131	2 533	61.3
2. Mexico City	14	21 777	12 891	59.2
3. Santiago	2	3 117	1 371	44.0
4. Rosario	1	98	30	30.6
5. Havana	6	4 407	1 146	26.0
6. Montevideo	2	1 211	277	22.9
7. Rio de Janeiro	1	1 348	276	20.5
8. Cordoba	2	1 526	234	15.3
9. Buenos Aires	6	3 497	435	12.4
10. Caracas	8	8 669	985	11.4
11. Porto Alegre	1	1 546	157	10.2
12. Belo Horizonte	1	749	15	2.0
13. San Jose	1	953	18	1.9
14. Medellin	4	3 745	51	1.4
15. Bogota	6	5 939	58	1.0
16. Cali	4	940	7	0.7
17. Barranquilla	3	550	1	0.2
18. Lima	4	3 096	0	0.0
19. San Salvador	2	1 323	0	0.0
20. Bucaramanga	1	870	0	0.0
21. La Paz	1	846	0	0.0
22. Mendoza	3	716	0	0.0
23. Guatemala	1	477	0	0.0
24. Santiago de Cuba	2	281	0	0.0
25. Kingston	1	250	0	0.0
26. Holguin	1	231	0	0.0
27. Maracaibo	2	174	0	0.0
28. Curitiba	1	137	0	0.0
29. Cartagena	1	21	0	0.0
	93	72 625	20 485	28.2

Table 19

REDPANAIRE (1967 - 1974)

Cities included in the Network in decreasing order of the percentage of all samples collected exceeding values suggested as Reference Levels

City	Stations in city	Maximum No. of months of sampling	Total samples collected	Samples exceeding the R.L.	%
1. São Paulo	11	66	8 237	4 343	52.7
2. Rosario	1	8	290	148	51.0
3. Mexico City	14	80	44 290	21 316	48.1
4. Montevideo	2	36	2 708	998	36.9
5. Santiago	2	82	6 331	2 328	36.8
6. Buenos Aires	6	72	7 174	2 454	34.2
7. Havana	6	58	8 987	3 073	34.2
8. San Salvador	2	46	2 739	875	31.9
9. Rio de Janeiro	1	86	2 760	687	24.9
10. Cordoba	2	41	3 212	500	15.6
11. Mendoza	3	37	1 751	262	15.0
12. Curitiba	1	5	284	26	9.2
13. Caracas	8	67	17 960	1 447	8.1
14. Porto Alegre	1	52	3 147	226	7.2
15. Belo Horizonte	1	34	783	48	6.1
16. Medellin	4	38	7 523	434	5.8
17. Guatemala	1	18	1 014	55	5.4
18. Bogota	6	81	12 178	457	3.8
19. Barranquilla	3	30	2 528	82	3.2
20. San Jose	1	34	1 822	47	2.6
21. Cartagena	1	14	258	6	2.3
22. Cali	4	24	2 083	48	2.3
23. Bucaramanga	1	40	1 811	27	1.5
24. La Paz	1	29	1 730	21	1.2
25. Kingston	1	22	736	7	1.0
26. Holguin	1	9	471	3	0.6
27. Lima	4	68	7 688	40	0.5
28. Maracaibo	2	5	401	1	0.2
29. Santiago de Cuba	2	11	657	1	0.2
	93		151 553	39 960	26.4

reports have been received from them up to December 1973. Only station 1 has collected samples during a sufficiently long period, a total of 66 months. The rest began operating in 1973 and have submitted data only for that year. However, a total of 8 237 samples have been collected, of which 4 343 (52.7%) exceeded the Reference Levels. The highest monthly average for sulfur dioxide in the whole Network was found at Sao Paulo 11 in October 1973, a concentration of 359 $\mu g/m^3$, more than five times the Reference Level and six times the WHO Long-Term Goal. The maximum daily value reported in the city reached 822 $\mu g/m^3$, a concentration recognized as potentially harmful to human health.[10]

According to the above data, the city is being affected by a serious air pollution problem. State authorities are aware of this and have undertaken a very vigorous program, without any doubt one of the best operating in Latin America, which from the beginning has received technical assistance from PAHO and financial assistance from the United Nations Development Program (UNDP). A continuous monitoring and evaluation program should determine in the future if these control activities are producing sucessful results, or if these efforts need to be increased even more.

12.2 Rosario

Fifty-one percent of the samples taken in this city exceeds the Reference Levels. However, results have been received from only one station, operating for eight months, with a total of 290 samples. Although these values should be considered only as preliminary figures, the high concentrations found justify the expansion of the evaluation program which, if it confirms the previous results, will show the urgency of implementing efficient prevention and control measures.

12.3 Mexico City

Fourteen REDPANAIRE stations have operated in Mexico City, some of them for an 80-month period, collecting a total of 44 290 samples - the highest figure for the whole network - equivalent to 29.2% of all samples included in this report. Of this total, 21 316 samples (48.1%) exceeded the Reference Levels. This excess was very sizable in many cases: for settled dust it was over 17 times the Reference Level; suspended dust values showed monthly averages more than three times the Reference Level and maximum daily values almost ten times this amount; for sulfur dioxide the latter were more than 14 times greater than the basis for comparison.

This has led the Mexican Government to start one of the most important programs, in terms of the amount of resources allocated to it, operating in Latin America. The Under-Secretariat for Environmental Improvement (Subsecretaría de Mejoramiento del Ambiente) organized in 1972 as a special agency of the Secretary for Health and Assistance (Secretaría de Salubridad y Asistencia) has a staff of over 500, nearly 50% of them professionals, and a budget that has allowed it to start impressive monitoring, prevention, and control programs.[11] A computerized automatic network of sampling stations is being set up which will provide better, more precise and more rapid information about conditions prevalent in the city. The Mexican Environmental Protection Law is a model of its kind, and CEPIS has helped to make it known in other countries of the continent.

Although the monitoring program in Mexico City is no longer using REDPANAIRE equipment and techniques, CEPIS hopes to be able to continue collecting the information obtained and to include it in future reports of the situation in Latin America and the Caribbean. Likewise, it is expected that before long the energetic and extensive program of the Mexican Government will begin to show the desired results, which should be reflected in the reduction of pollutant concentrations in the atmosphere, with the consequent benefits to the health and economy of its inhabitants.

12.4 Montevideo, Santiago, and Buenos Aires

The capitals of the three countries of the southern cone of America present very similar conditions, in terms of the results obtained in the analyses included in the present report. Over one third of all samples exceeded the Reference Levels, with 36.9% for Montevideo, 36.8% for Santiago, and 34.2% for Buenos Aires. This is probably a reflection of the relatively high level of industrialization reached by the three countries and the fact that climatic conditions in the three cities require household heating, and make hot water systems and home incinerators more frequent, which contribute in an important manner to higher pollutant concentrations. Figures obtained generally show a clear seasonal change, with substantial increments during the winter months.

Although Buenos Aires shows results from six stations, to date they have only two sets of equipment. One of these was installed sequentially in five different points of the city. Although this helps show the existing situation in different zones, it makes it difficult to calculate trends or to prove the existence of important changes. However the number of samples, a total of 7 174, gives a certain validity to these results.

A similar situation prevails in Montevideo, where the same equipment was operated in two different places. On the other hand, two stations have been in use in Santiago, where the program is now being considerably expanded. Meteorological and topographical conditions in this city are, from the air pollution point of view, very unfavorable and contribute to the magnitude of the problems.

Health authorities in the three countries, with PAHO support and with that of the UNDP in Chile, are trying to develop control activities to lower concentrations to more acceptable levels. However, various circumstances have kept sufficient resources from being allocated to these activities until now.

12.5 Havana, Holguin, and Santiago de Cuba

Havana shows a situation similar to the three cities of the previous group, with the same percentage of samples exceeding the Reference Levels as Buenos Aires (34.2%). This figure should be considered as quite significant since it includes the results of a total of 8 987 samples collected at six stations. The demographic and industrial growth which the city is experiencing will tend to make the situation more serious.

The Ministry of Health of Cuba is developing quite an efficient program of surveillance and monitoring, which is being constantly expanded and will provide reasonably good knowledge of the prevailing conditions, as far as air pollution is concerned, in all the major cities of the country and those where, according to the governmental programs, greater industrial and economic development is expected. A few data from Holguin and Santiago de Cuba were received in time to be included in this report. They seem to show that conditions are not a problem for the time being, with only 0.6% and 0.2% of the total number of samples collected exceeding the Reference Levels. Continuation and expansion of monitoring and surveillance activities should confirm or modify these preliminary conclusions, and help decide the type of preventive activities to be implemented in both these cities and in the others recently incorporated into the Cuban Government program.

12.6 San Salvador, Guatemala, and San Jose

The three Central American capitals included in the REDPANAIRE show very different situations, with a total of 31.9% of the samples in excess of the Reference Levels in the case of San Salvador, decreasing to 5.4% in Guatemala and 2.6% in San Jose. In the first city there are two stations in operation while the others had only one station each as of the closing date for this report.

San Salvador has a serious problem with relation to suspended dust. Its sources should be determined in order to implement the needed corrective and preventive steps, both to diminish present levels and to curb new emissions. On the other hand, sulfur dioxide concentrations seem to be very low and they are not, at present, a cause for concern. Guatemala and San Jose should expand their monitoring and surveillance programs to see if additional measurements confirm the preliminary conclusions obtained.

12.7 Rio de Janeiro

Rio de Janeiro is implementing a fairly extensive measurement program, which has received PAHO technical assistance and financial support from the UNDP, and has also initiated prevention and control activities. Only the measurements taken at the one REDPANAIRE station operating in this city are included in the present report. However, one fourth of all the samples collected, a total of 2 760 over 86 months, exceeded the Reference Levels. This situation reflects the need for a prevention and control program such as the one the city is striving to implement.

12.8 Cordoba and Mendoza

These two Argentinian cities are important centers of industrial development. In both cases the REDPANAIRE stations in operation show that 15% of all samples collected exceeded the Reference Levels, a situation that indicates the urgency of implementing prevention and control programs.

12.9 Curitiba, Porto Alegre, and Belo Horizonte

These three cities of Brazil present an intermediate situation, with percentages of samples exceeding the Reference Levels - 6.1% to 9.2% - that cannot be considered satisfactory. To date, there is only one station in each city. Samples have been collected during relatively long periods in Porto Alegre and Belo Horizonte, but only for about five months in Curitiba; therefore, results for the latter should be considered as preliminary. Monitoring and surveillance programs should be expanded in all three cities to get a good knowledge of the real prevalent conditions and to help determine the most expedient prevention and control measures.

12.10 Caracas and Maracaibo

The eight stations in Caracas, four operated by the Sanitary Engineering Division of the Ministry of Health and Social Welfare, and the other four by the Sanitary Engineering Department of the Universidad Central de Venezuela, point in general to a reasonably good situation, although 8.1% of all samples exceeded the Reference Level. However, these high samples were found mainly at two stations. Except for settled dust samples, with relatively high results at all stations although lower than those in most of the Network, only Caracas 1 shows an important percentage of samples (15.1%) exceeding the Reference Level for suspended dust (Table 12). All others show very low results. While at three of them the number of samples in excess ranges from 0.1% to 0.2% of the total, at the other four all samples are below the Reference Level. Even if results are compared with the stricter WHO Long-Term Goals, only Caracas 1 shows a general average over 40 $\mu g/m^3$. All other stations have general averages between 14.4 and 25.4 $\mu g/m^3$, a condition that can be considered as quite good.

Something similar can be found in the case of sulfur dioxide. Only one station, Caracas 3, exceeds the REDPANAIRE Reference Levels and the WHO Long-Term Goals (Table 14). The other seven show much lower averages, with a maximum of 15.2 $\mu g/m^3$. Caracas 3 is the only one where a large percentage of samples (56%) exceeds the Reference Level (Table 17). Of the remaining stations, at Caracas 2 just 0.1% of all samples exceeds the Reference Level, while all samples taken at the other six are below this figure.

It is possible that the heavy motor vehicle traffic in Caracas may be causing a serious problem due to carbon monoxide, and perhaps to photochemical oxidants. The Universidad Central de Venezuela and the Ministry of Health and Social Welfare, both with PAHO assistance and the latter with financial support from the UNDP, are trying to investigate this situation. Venezuela has extensive economic resources, well-organized and efficient health authorities and excellent universities and professionals. Thus, it is likely that before long the country will have an effective program which will lead to a better diagnosis of existing conditions, to the control of current problems and to the prevention of new ones.

In Maracaibo very few samples were collected during a five-month period. Only one sample (0.2%) of 401 analyzed exceeds the Reference Levels. This seems to show acceptable conditions that should be confirmed by means of more prolonged monitoring and surveillance programs.

12.11 Medellin, Bogota, Barranquilla, Cartagena, Cali, and Bucaramanga

Colombia has the most extensive network in the whole Region, with 19 stations operating in six cities. Medellin shows the highest number of samples in excess of the Reference Levels, with 5.8% of the total. These percentages are a little lower in the other cities; i.e. 3.8% in Bogota, 3.2% in Barranquilla, 2.3% in Cartagena and Cali, and only 1.5% in Bucaramanga. These figures seem to show that Colombia has a problem that is not yet too serious, but one that will be increasing in conjunction with the socio-economic development of the country. This gives the health authorities an excellent opportunity to establish, at a relatively low cost, a good monitoring and surveillance program to determine the real magnitude of the situation and its trends, and a preventive and control program which will not only eliminate already existing problems, possibly still limited in number, but will prevent the appearance of new ones as well. The Ministry of Public Health is aware of this and is implementing through its Environmental Sanitation Division (División de Saneamiento Ambiental) a program which, with the needed resources, could constitute a model for many other countries within the continent.

12.12 La Paz and Kingston

In these two cities samples have been collected by only one REDPANAIRE station, for a relatively short period. In each case the health authorities were unable to continue its operation. Results obtained show an acceptable situation, with only 1 to 1.2% of the samples in excess of the Reference Levels. Efforts should be made to resume measurements in both cases, perhaps for short periods of possibly one week per month. This will help ascertain if the situation is being maintained, establish the future trend of the problem, and make a long-term forecast showing the type of preventive measures that should be applied in due course.

12.13 Lima

The four stations installed in Lima, three operated by the Institute of Occupational Health of the Ministry of Health, and the fourth one by the Sanitary Engineering Program of the Universidad Nacional de Ingeniería, have collected a total of 7 688 samples over a 68-month period. Only 40 samples (0.5%) showed values in excess of the REDPANAIRE Reference Levels. Even if these values are compared with the stricter limits of the WHO Long-Term Goals, the average of the four stations is still below these figures. The maximum daily value obtained for suspended dust in the whole city is exactly the REDPANAIRE Reference Level, 100 $\mu g/m^3$ (Table 11). Only at Lima 1 did the maximum monthly average exceed the WHO Long-Term Goal of 40 $\mu g/m^3$. At the other three stations the maximum monthly averages were below these figures (Table 10).

This seems to reflect a fairly acceptable situation, which could be associated with the relatively small number of industries in the city and with its temperate and very uniform climate which make household heating unnecessary. However, measurements made by the Institute of Occupational Health, by methods other than those utilized by the REDPANAIRE, show higher average concentrations than those obtained by the four network stations operating in the city.[12] It is not easy to compare the two sets of figures, nor establish the reason for these differences. Therefore, it would be advisable to try to determine as precisely as possible the effective concentration of air pollutants by means of a suitable research and evaluation program which would require increased financial and human resources.

13. TRENDS

The data for most of the stations exhibit clear cyclic or seasonal variation and many of the time-series showed evidence of a long-term trend in data values. For this reason a trend analysis was carried out by means of the linear regression and correlation techniques.

Since time-series are being dealt with, each series of contaminant values was regressed against absolute time expressed in months, and the corresponding simple correlation coefficient was calculated. A test of significance was made at the 95% confidence level of the null hypothesis that no significant trend exists, that is, that long-term variations in the data are strictly of a random nature. For those cases in which the hypothesis was rejected we are forced to conclude that a significant uniform trend exists in the observed data.

Several precautions should be taken in interpreting the results of such a trend analysis:

1. A linear model was assumed for the trend analysis. It is possible that a trend could exist for a particular station that could be better described by a higher order curvilineal or polynomial, and that the linear model would erroneously obscure the trend. However, such cases, if they existed, would be few and would be immediately recognizable upon analyzing a plot of the data.

2. The model will not explain the seasonal, cyclical or stochastic (random) variation in the data. To ensure that the trend component is not confused with shorter-term sources of variance, only stations with a minimum of 24 monthly observations were subjected to trend analysis.

3. The linear model is not assumed to be a structural model to explain the generating mechanism giving rise to the observed phenomena, but is used only to determine if there is a significant long-term trend in the observed data.

4. The analysis assumes that the data are homogeneous, that is, the underlying generating mechanism is unchanged throughout the period of record. If changes are introduced either by natural or man-made alterations in the environment, an inconsistent trend component may be observed and the analysis will be invalidated.

A clear example of this occurs in the case of Caracas 3 for sulfur dioxide. According to the trend analysis, done by the above-described technique, the computer indicated "No significant trend". However, in Graph 1 an obvious reduction of the monthly averages can be seen from October 1972 on. Data presented in Table 20 show that these averages, with the cyclic variations already mentioned, oscilated between 100 to 200 $\mu g/m^3$ from 1969 to 1972, with a maximum of 207.2 $\mu g/m^3$ in May 1970. Of the samples collected between 1969 and 1971, 766 (98.7%) of them exceeded the Reference Level, with a daily maximum of 507.2 $\mu g/m^3$ in August 1970. In August 1972 there is an abrupt change. All 705 samples taken since September that year were below the Reference Level, with monthly averages between 46.8 and 3.6 $\mu g/m^3$, and a daily maximum of 64.7 $\mu g/m^3$.

Sufficient data have not been received to establish the reasons for this sharp change. It would be very interesting to have this matter investigated by the institution in charge of this station. It is likely, however, that either some important pollutant sources disappeared at that time, or the station was moved. In any case homogeneity of data generation would have been lost, and this loss would not be detected by the applied analysis. This seems to be the only case of this nature.

Within the limits established by the above assumptions, the existence of a significant trend will indicate to the control authorities that the observed concentrations of a given pollutant are steadily increasing or decreasing, and will make it possible to establish or modify, if necessary, control policies in order to adopt the most appropriate measures.

Observed trends are grouped as increasing, decreasing, and not statistically significant, and are presented in Table 21. Nineteen stations (41.3%) out of 46 showed an increasing trend for settled dust, 13 (26.5%) out of 49 for suspended dust, and 15 (30.6%) out of 49 for sulfur dioxide. None of the stations showed a decreasing trend which would indicate, with the possible exception of what happened in the case of Caracas 3, that the problem in general is increasing. This seems logical since both the number of inhabitants and the number of industries are increasing in all cities, while prevention and control programs are still in their initial phase. It would also appear, in the absence of other indications to the contrary, that existing programs were not sufficient to reduce the air pollution problems affecting the respective cities.

In Table 21B it can be seen that the stations with increasing trends for settled dust and sulfur dioxide are distributed among nine cities, and among six cities for suspended dust. Problems were on the rise especially in Mexico City, where four to eight stations showed incresing trends for the different pollutants. Caracas seems to have a problem with both settled and suspended dust. Concentrations of sulfur dioxide are increasing at six Mexico City stations, two in Buenos Aires and one station in seven other cities.

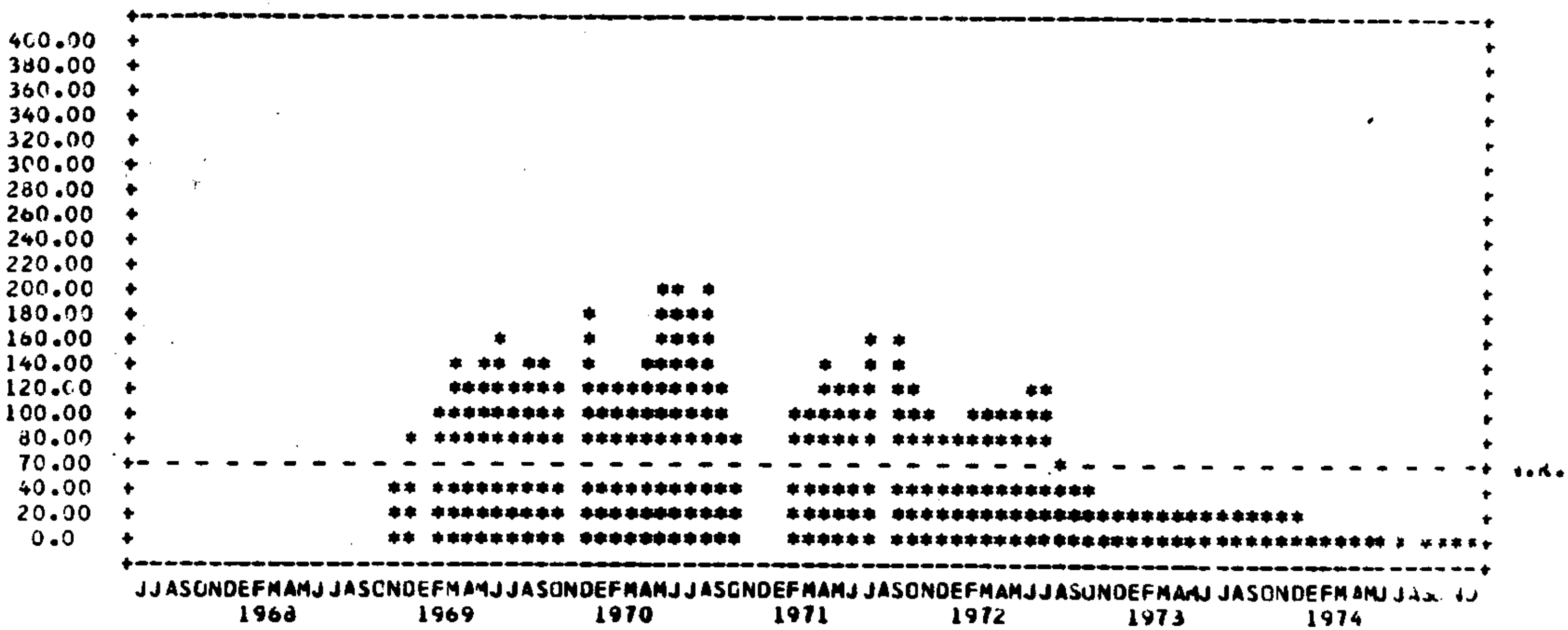
14. DATA PRESENTATION

The large amount of data collected - 151 553 - makes it difficult to include them in detail in this report. On the other hand, they are probably

Graph 1

CARACAS 3

ANHIDRIDO SULFUROSO
(Sulfur dioxide)
MICROG/M3



NO HAY TENDENCIA SIGNIFICATIVA

Table 20

REDPANAIRE. Monthly averages for sulfur dioxide obtained at station Caracas 3 (1968-1974)

(μg/m³)

Year	Month	Average
1968	November	54.1
	December	70.7
1969	February	104.0
	March	134.5
	April	117.4
	May	136.0
	June	169.9
	July	124.0
	August	148.6
	September	134.3
	October	117.4
	December	173.8
1970	January	124.1
	February	116.9
	March	112.2
	April	137.6
	May	207.2
	June	202.2
	July	186.4
	August	194.1
	September	130.0
	October	87.4
1971	February	108.6
	March	102.9
	April	134.0
	May	112.4
	June	122.9
	July	157.1
	September	150.2
	October	117.2
	November	100.3
	December	82.2

Year	Month	Average
1972	January	89.3
	February	107.7
	March	94.6
	April	105.9
	May	100.6
	June	111.7
	July	111.0
	August	60.0
	September	46.8
	October	36.4
	November	29.3
	December	22.3
1973	January	25.0
	February	27.1
	March	23.8
	April	20.7
	May	21.7
	June	17.0
	July	15.0
	August	18.9
	September	19.9
	October	15.4
	November	13.0
	December	14.2
1974	January	8.1
	February	7.8
	March	9.0
	April	8.1
	May	7.3
	June	6.3
	July	6.5
	September	3.6
	October	3.7
	November	5.4
	December	8.0

Table 21

REDPANAIRE (1967 - 1974)

A. Trends of monthly averages for three pollutants collected at 49 stations with data corresponding to 24 or more months

Trend	Settled Dust		Suspended Dust		Sulfur Dioxide	
	Stations	%	Stations	%	Stations	%
Increasing	19	41.3	13	26.5	15	30.6
No statistically significant trend	27	58.7	36	73.5	34	69.4
Total	46	100.0	49	100.0	49	100.0

B. Stations with increasing trends

Settled Dust		Suspended Dust		Sulfur Dioxide	
City	Station N°	City	Station N°	City	Station N°
La Paz	1	Mendoza	2	Buenos Aires	1-23
Belo Horizonte	1	La Paz	1	Cordoba	1
Sao Paulo	1	Barranquilla	2	La Paz	1
Medellin	2	Medellin	1-2-4	Belo Horizonte	1
San Jose	1	Mexico	1-2-5-6	Sao Paulo	1
San Salvador	1	Caracas	2-3-4	Bogota	2
Mexico City	1-2-3-5-6-7-8-11			Bucaramanga	1
Montevideo	1			Havana	1
Caracas	2-3-4-5			Mexico City	1-2-3-4-5-6
9	19	6	13	9	15

only of interest to the institutions in charge of operating the stations. To prepare the analytical study presented in this document all the monthly reports received were recorded on punched cards which, after verification, were processed by computer. Tables with monthly averages for the three pollutants were prepared in this way. In the cases of suspended dust and sulfur dioxide, for which daily samples are collected, the standard deviation, number of samples, maximum and minimum value obtained and the percentage of samples exceeding the corresponding Reference Level have also been included for each month.

Similarly, monthly averages have been plotted by the computer in the form of bar histograms made up of colums of asterisks, showing the Reference Level for each pollutant with a dotted line. When there is no data for a specific month the corresponding space is left blank.

Tables have been prepared for each one of the 93 stations included in the present report. Graphs have been prepared only for stations collecting samples during at least 24 months. As mentioned before, it is felt that shorter periods do not demonstrate significant trends.

As an example, one of the two pages of data from station Mexico 1 is included as Table 22, and in Graphs 2, 3 and 4 the monthly average for each pollutant for the same station is presented. All tables and graphs have been reproduced in a separate volume which will be distributed as an Annex to the present report to the institutions in charge of operating the stations. In addition, there are a very limited number of copies available from CEPIS to selected agencies which request them for the purpose of making special studies. This procedure has been adopted due to the high cost of publications and because it is hoped to better serve the Member Countries by presenting this report in a shorter volume, easier to read and manipulate, rather than to weight it down with figures.

15. FUTURE PROGRAMS

As this report seems to indicate, in Latin America there are two cities with serious air pollution problems. Both have very active government programs underway and it is expected that they will be able to reduce pollutant levels. In another nine cities the situation is relatively serious and should be of concern to the corresponding authorities. In the rest, problems seem to be still in an initial stage. However, in many cases data come from one isolated station and cannot, therefore, be considered as representative of the real situation. It seems indispensable to expand evaluation and monitoring programs as soon as possible to establish the effective reality by collecting a sufficient number of samples to provide the necessary representativity.

In relation to prevention and control, it might be thought that the cities where problems are still in an incipient stage can take their time, avoiding the need to spend funds on programs without sufficiently high priority. A medium-term analysis will show immediately that such complacency could be dangerous and costly.

Table 22

[illegible] - CEPIS/OPS

MEXICO 1

MES	POLVO SEDIMENTABLE MG/CM2/30 DIAS	POLVO EN SUSPENSION MICROG/M3 PROM	S	N	MAX	MIN	%EX	[illegible] PROM	S	N	MAX	MIN	%EX
AÑO 1967													
AGOSTO	2.48	67.3	25.7	20	130.0	21.0	15.0	72.4	23.4	[illegible]	[illegible]	[illegible]	32.4
SETIEMBRE	2.45	68.0	26.9	30	144.0	27.0	13.3	58.6	22.3	[illegible]	[illegible]	[illegible]	[illegible]
OCTUBRE	1.31	70.3	20.2	31	144.0	31.0	16.1	85.6	43.8	[illegible]	[illegible]	[illegible]	[illegible]
NOVIEMBRE	0.39	108.3	34.5	30	255.0	27.0	53.3	121.4	52.4	[illegible]	[illegible]	[illegible]	[illegible]
DICIEMBRE	*****	120.0	50.3	30	247.0	35.0	60.7	58.7	35.0	[illegible]	[illegible]	[illegible]	[illegible]
AÑO 1968													
ENERO	0.83	136.8	61.9	31	338.0	35.0	64.5	121.0	38.7	[illegible]	[illegible]	[illegible]	43.9
FEBRERO	1.57	112.8	56.6	29	222.0	26.0	55.2	94.6	46.1	[illegible]	[illegible]	[illegible]	[illegible]
MARZO	0.79	96.6	44.3	30	202.0	21.0	33.3	59.5	77.8	[illegible]	[illegible]	[illegible]	54.8
ABRIL	0.72	85.5	27.3	30	136.0	40.0	33.3	75.2	50.8	[illegible]	[illegible]	[illegible]	[illegible]
MAYO	0.87	81.6	32.8	31	168.0	25.0	22.6	68.5	41.3	[illegible]	[illegible]	[illegible]	[illegible]
JUNIO	2.07	70.1	22.4	30	109.0	19.0	6.7	46.0	29.6	[illegible]	[illegible]	[illegible]	[illegible]
JULIO	3.46	62.6	18.5	31	111.6	39.1	3.2	59.8	35.0	[illegible]	[illegible]	[illegible]	[illegible]
AGOSTO	1.73	58.5	17.3	31	98.0	32.0	0.0	77.5	48.2	[illegible]	[illegible]	[illegible]	50.0
SETIEMBRE	3.82	55.4	30.8	31	112.4	0.0	6.5	51.1	33.0	[illegible]	[illegible]	[illegible]	[illegible]
OCTUBRE	2.68	71.7	20.8	31	144.4	28.2	19.4	75.8	37.4	[illegible]	[illegible]	[illegible]	[illegible]
NOVIEMBRE	1.07	115.5	45.3	30	261.1	59.8	56.7	98.9	37.0	[illegible]	[illegible]	[illegible]	73.3
DICIEMBRE	-0.93	117.2	70.8	31	401.3	25.8	45.2	93.8	52.2	[illegible]	[illegible]	27.1	64.5
AÑO 1969													
ENERO	1.04	170.0	116.0	31	707.1	21.0	87.1	119.6	41.2	[illegible]	[illegible]	[illegible]	93.0
FEBRERO	1.01	193.7	99.2	27	414.5	57.2	77.8	100.9	35.9	[illegible]	[illegible]	[illegible]	80.8
MARZO	0.73	97.2	39.4	31	186.7	40.4	45.2	94.2	38.3	[illegible]	[illegible]	[illegible]	77.4
ABRIL	0.99	127.0	45.4	29	232.6	64.8	69.0	139.6	42.5	[illegible]	[illegible]	[illegible]	[illegible]
MAYO	1.46	94.4	39.2	31	200.0	25.1	38.7	112.7	53.4	[illegible]	[illegible]	[illegible]	[illegible]
JUNIO	0.96	61.4	22.1	27	98.8	19.5	0.0	110.2	34.3	[illegible]	[illegible]	[illegible]	[illegible]
JULIO	1.52	68.8	22.0	28	134.1	36.3	7.1	106.4	47.8	[illegible]	[illegible]	[illegible]	[illegible]
AGOSTO	0.97	62.8	22.0	31	111.4	21.4	6.5	71.9	22.1	[illegible]	[illegible]	27.0	[illegible]
SETIEMBRE	1.45	67.5	25.4	29	165.7	22.5	6.9	80.5	30.2	[illegible]	[illegible]	[illegible]	[illegible]
OCTUBRE	1.54	95.2	36.9	31	193.8	32.3	35.5	118.7	60.1	[illegible]	[illegible]	[illegible]	[illegible]
NOVIEMBRE	1.06	126.4	47.4	30	232.5	37.9	76.7	155.5	57.1	[illegible]	[illegible]	[illegible]	[illegible]
DICIEMBRE	1.25	169.2	75.7	31	337.0	65.8	77.4	184.1	64.1	[illegible]	[illegible]	[illegible]	103.0
AÑO 1970													
ENERO	1.05	190.8	60.1	28	375.1	112.2	100.0	188.3	86.8	[illegible]	[illegible]	[illegible]	[illegible]
FEBRERO	0.52	108.9	44.2	28	227.0	34.9	57.1	111.8	50.5	[illegible]	[illegible]	[illegible]	77.4
MARZO	0.63	118.6	37.7	31	207.3	53.2	67.7	169.1	58.9	[illegible]	[illegible]	[illegible]	100.0
ABRIL	1.82	127.8	40.4	30	270.0	71.6	76.7	189.9	63.6	[illegible]	[illegible]	[illegible]	[illegible]
MAYO	2.20	92.7	28.5	31	160.9	43.7	41.9	141.5	52.5	[illegible]	[illegible]	[illegible]	90.3
JUNIO	2.19	66.0	18.9	30	108.5	20.1	3.3	114.3	42.8	[illegible]	[illegible]	[illegible]	[illegible]
JULIO	1.84	55.7	15.6	30	105.0	27.8	3.3	104.8	37.9	[illegible]	[illegible]	[illegible]	76.7
AGOSTO	1.77	53.6	20.1	30	102.3	22.2	3.3	97.7	40.3	[illegible]	[illegible]	[illegible]	76.7
SETIEMBRE	1.60	58.3	20.6	28	130.0	34.7	3.6	73.2	32.8	[illegible]	[illegible]	[illegible]	44.8
OCTUBRE	1.41	79.2	26.5	31	143.3	33.3	19.4	136.0	46.2	[illegible]	[illegible]	[illegible]	100.0
NOVIEMBRE	1.08	122.4	48.5	29	223.3	42.1	69.0	202.5	63.4	[illegible]	[illegible]	[illegible]	100.0
DICIEMBRE	1.27	172.2	103.3	31	533.7	53.9	60.6	232.5	80.9	[illegible]	[illegible]	[illegible]	[illegible]

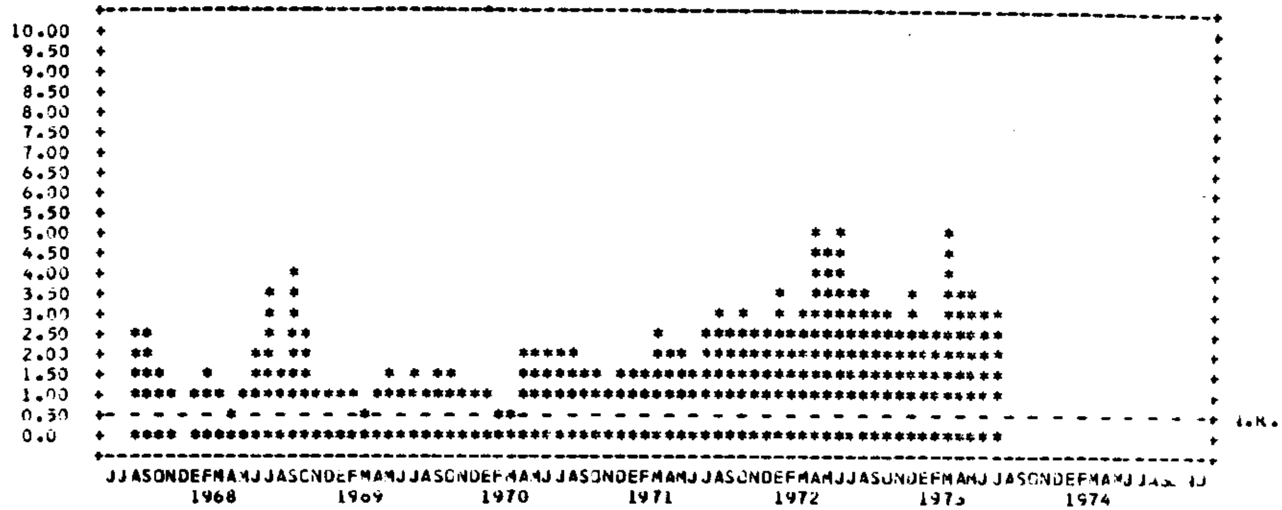
REDPANAIRE - CEPIS/OPS

Graph 2

MEXICO 1

POLVO SEDIMENTABLE

MG/CM2/30 DIAS



HAY TENDENCIA SIGNIFICATIVA

INTERSECCION	=	0.611
COEF. DE REGRESION	=	0.035
COEF. DE CORRELACION	=	0.632
NUM. DE OBSERVACIONES	=	71

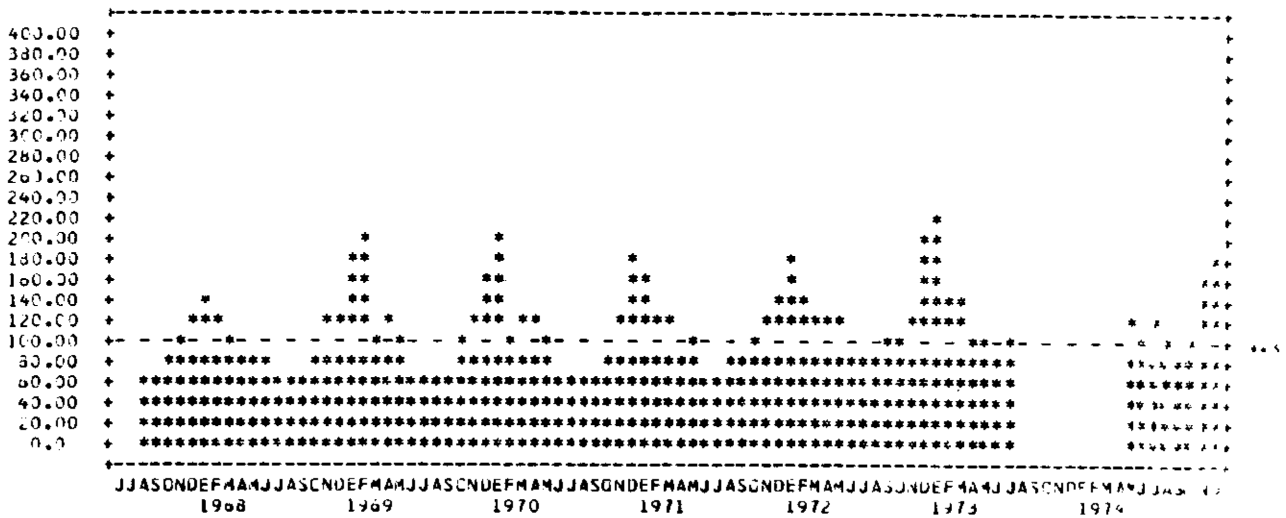
RECPANAIRE - CEPIS/OPS

Graph 3

MEXICO 1

(Suspended Dust)

MICROG/M3



HAY TENDENCIA SIGNIFICATIVA

INTERSECCION	=	88.094
COEF. DE REGRESION	=	0.401
COEF. DE CORRELACION	=	0.260
NUM. DE OBSERVACIONES	=	80

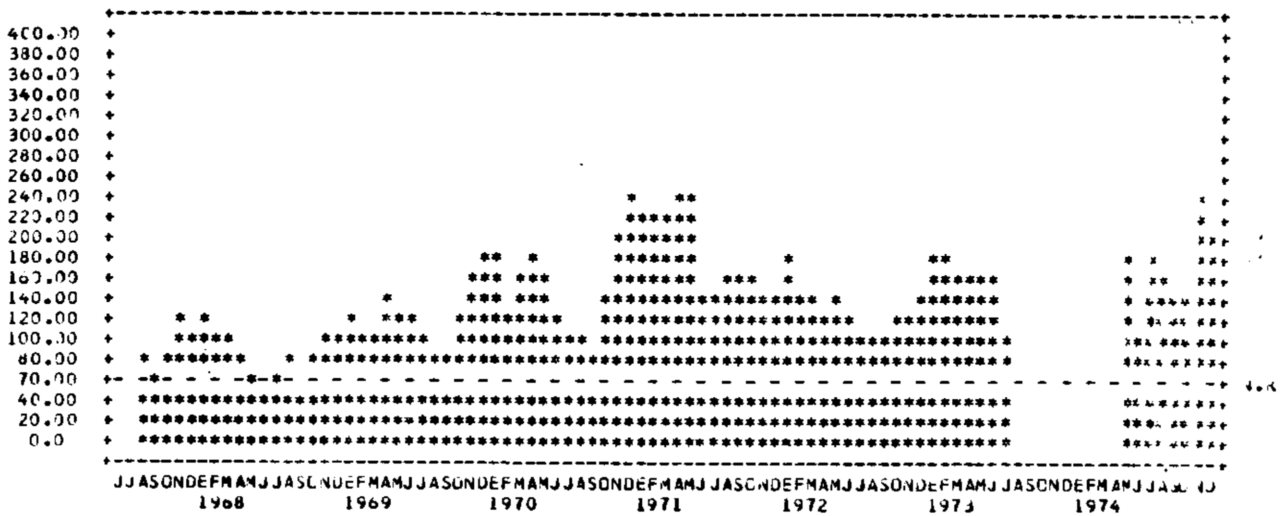
REDPANAIRE - CEPIS/OPS

Graph 4

MEXICO 1

ANHIDRIDO SULFUROSO

MICROG/M3



HAY TENDENCIA SIGNIFICATIVA

INTERSECCION	=	86.095
COEF. DE REGRESION	=	0.992
COEF. DE CORRELACION	=	0.514
NUM. DE OBSERVACIONES	=	80

Table 23 presents some figures related to the projected growth of Latin America during the next 24 years, i.e., until the year 2000. Part A contains population projections until the year 2000 as they appear in a study made in 1963.[13] These are based on data for 1960 and consider three hypothesis of growth: low, medium and high. They will give respectively for the last date, 532.4, 638.1 or 686.1 million inhabitants.

In part B a new study prepared ten years later by ECLA[14] is presented. A comparison of the two studies can establish which of the three hypotheses represents the actual growth rate. Although the ECLA figure for 1960 is a little lower than the one used in the first study the figure for 1975 has already reached an intermediate position between the low and medium hypotheses, and the projections for the year 2000 point to a population of 659.3 millions, intermediate between the medium and high hypotheses. Barring unexpected circumstances, which are highly unlikely, population in Latin America and the Caribbean will at least double in the next 24 years. Food, housing, clothing, education, public services, transportation and work will have to be provided for over 300 million more inhabitants, in addition to the current population. This will mean, by necessity, more industries, more motor vehicles - either private or public - more electricity, more heating and probably more garbage incineration systems. In summary, an inevitable increase in air pollution unless the corresponding authorities initiate the essential preventive and control measures in time.

It should be clearly understood that the development of evaluation and monitoring programs, as well as those for prevention and control, requires financial resources and properly trained operational personnel. To assign the first and to train the second is a must. This will not be an easy task and will not be accomplished in a short term. It must be kept in mind that a reasonably efficient program seems to require government financing equivalent to about US$0.50 per inhabitant per year. With the possible exception of Mexico and Brazil, which have been allocating reasonably adequate budgets to these activities, no other country approaches this figure. The contents of this report should induce governmental authorities to start and finance, in due course, the evaluation, prevention and control programs required by their communities.

To date, the REDPANAIRE has been taking measurements exclusively in urban zones where, with the exception of isolated cases, the most serious problems can be found, both current and potential. They also constitute the fastest growing zones in the whole continent. To offer just one example, in Table 23C a projection of the population in Lima, Peru, between 1974 and 2000 is included, prepared from data presented by the Peruvian Delegation to the III Meeting of Health Ministers of the Andean Group (Caracas, November 1974).[15] According to the consolidated report prepared for that event, in 1974 Lima had a population of 3 302 000 inhabitants and a growth rate of 5% per year. If this rate is maintained, and according to unofficial data it seems to be increasing, by the year 2000 the population of Lima will reach 11 740 831 inhabitants; in other words, it will more than treble. This phenomenon, which seems to be unpreventable and is repeated in the majority of the capitals of the continent, will inevitably lead to ever more serious air pollution problems and to the deterioration of the quality of air breathed by their inhabitants. Even if the low pollutant concentrations reported by the four REDPANAIRE stations operating in Lima are confirmed,

Table 23

PROJECTIONS OF DEMOGRAPHIC GROWTH IN LATIN AMERICA, 1960-2000

A. According to United Nations. Taken from "World Population Prospects as Assessed in 1963", United Nations Population Studies No. 41. Quoted by Ehrlich, P.R. and Ehrlich, A.H.

Year	Growth Hiphotesis:	Population in millions		
		Low	Medium	High
1960		212.4	212.4	212.4
1970		281.8	283.3	283.4
1975		321.3	327.6	328.9
1980		362.3	378.4	383.2
1990		446.5	497.9	521.6
2000		532.4	638.1	686.1

B. According to ECLA. "1973 Latin America Statistical Yearbook" (24 countries: 20 countries plus Barbados, Guyana, Jamaica and Trinidad/Tobago).

Year	Population in millions
1960	210.3
1970	279.0
1975	322.0
1980	371.8
1990	495.1*
2000	659.3*

(*) Calculated at CEPIS, applying the 15.4% five-year rate used by CEPAL.

C. Population in Lima. Proyected from data contained in the Consolidated Report on Environmental Pollution in the Andean Group Countries, presented by the Peruvian Delegation to the III Meeting of the Ministers of Health of the Andean Group (Caracas, November 1974).

Year	Population	Growth rate
1974	3 302 000	5% per year
1975	3 467 100	
1980	4 424 995	
1990	7 207 851	
2000	11 740 831	

this explosive growth represents an imperative which demands the immediate development of ever more active and efficient evaluation, prevention and control programs.

On the other hand, this serious situation in the urban areas ought not to induce us to disregard what is happening in rural zones. A growing number of mineral and oil refineries are being installed throughout the Region and, in accordance with the policies adopted by almost every country which call for decentralization and the establishment of new centers of development, industries are being located in formally rural areas. This gives rise to high concentrations of air pollutants, enough to seriously affect the health of rural inhabitants and to produce important economic damages due to their effects on the flora and fauna, and especially through diminished agriculture and livestock yields. This can result in problems with serious consequences which should be evaluated as soon as possible.

The Pan American Health Organization (PAHO) and its Pan American Center for Sanitary Engineering and Environmental Sciences (CEPIS) deliver this report to the authorities, teaching institutions, professionals and technicians of the whole continent in the hope of contributing to the protection of the health of its inhabitants, fundamental mission commended to the Organization by the Member Countries. They are confident of being able to continue collaborating in the future to attain a better knowledge of the problem and the implementation of ever more efficient and effective prevention and control programs.

Lima, April 1976

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